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Joint Resolution authorizing the Public Printer to print Reports of the United States Fish Commissioner upon new Discoveries in regard to Fish-culture.

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That the Public Printer be, and he hereby is, instructed to print and stereotype, from time to time, any matter furnished him by the United States Commissioner of Fish and Fisheries, relative to new observations, discoveries, and applications connected with fish-culture and the fisheries, to be capable of being distributed in parts, and the whole to form an annual volume or bulletin not exceeding five hundred pages. The extra edition of said work shall consist of five thousand copies, of which two thousand five hundred shall be for the use of the House of Representatives, one thousand for the use of the Senate, and one thousand five hundred for the use of the Commissioner of Fish and Fisheries.

February 14, 1881.

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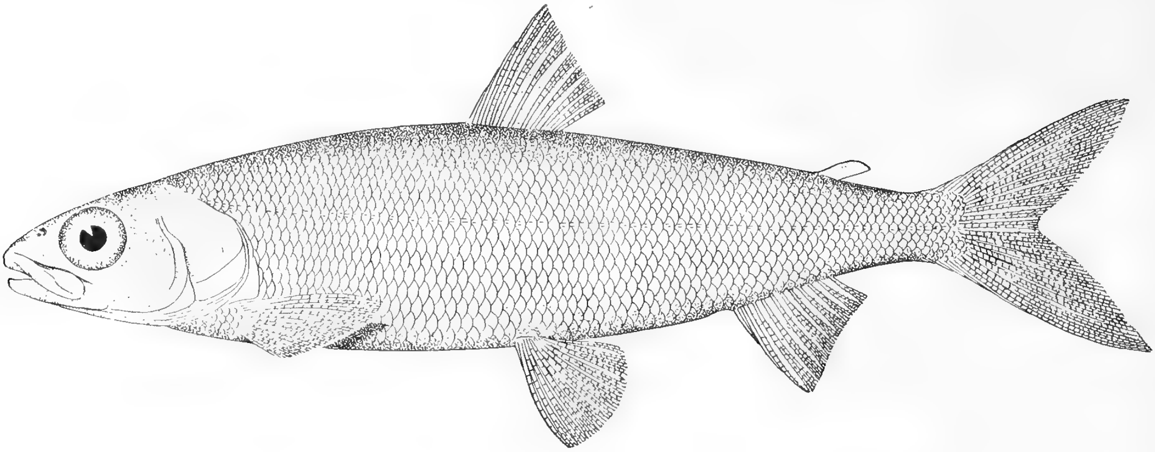

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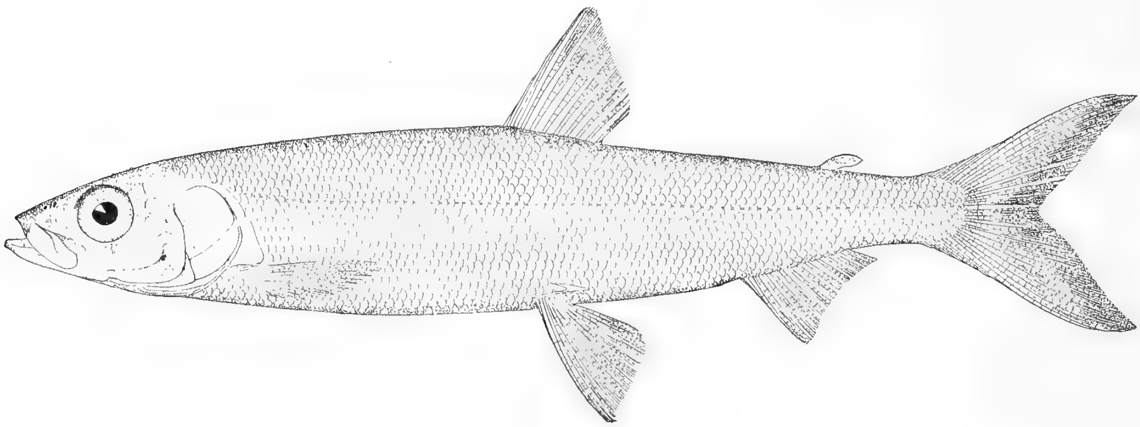

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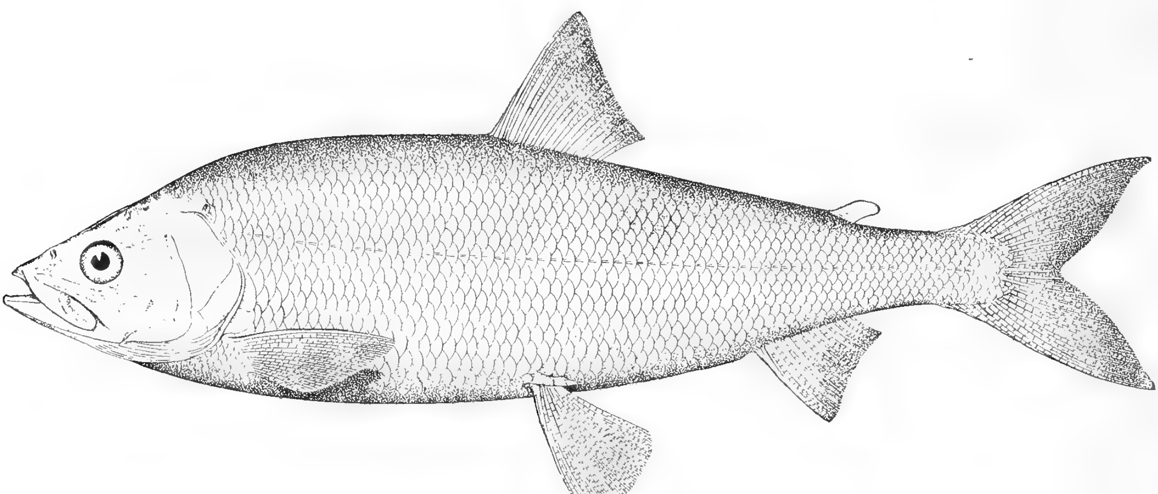

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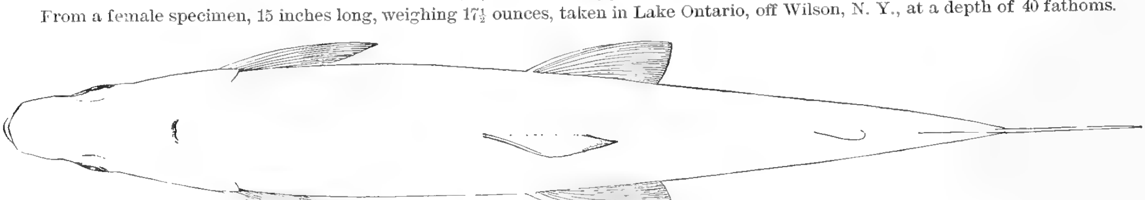

COREGONUS PROGNATHUS. Outline of fish viewed from above.

1.—NOTES ON TWO HITHERTO UNRECOGNIZED SPECIES OF AMERICAN WHITEFISHES.

By HUGH M. SMITH, M. D.

There are seven described species of whitefish whose range embraces the basin of the Great Lakes and which are more or less abundantly represented in the lakes and streams of that region. These are the common whitefish (*Coregonus clupeiformis*), the lake herring or cisco (*C. artedi*), the blackfin or bluefin whitefish (*C. nigripinnis*), the tullibee or mongrel whitefish (*C. tullibee*), the Musquaw River or Labrador whitefish (*C labradoricus*), the menominee or round whitefish (*C. quadrilateralis*), and Hoy's whitefish or the moon-eye (*C. hoyi*). Concerning the habits, movements, etc., of the first two of these we have a fairly satisfactory knowledge, chiefly because of their economic value, although there is yet much to be learned; but the published information regarding the five remaining species is exceedingly limited and consists largely of such observations as were recorded at the time the fish were first brought to public attention.

This deficiency of information is due to the comparatively slight commercial importance of most of the fishes, to the small size of one, to the relative rarity of several, and to the habit of two or three of frequenting the deepest water of the lakes where they are least accessible to the fisherman and the naturalist; but the deficiency is principally owing to the absence of biological surveys of the lake region and of systematic fieldwork.

In 1891, while visiting the American shore of Lake Ontario in the interests of the U. S. Commission of Fish and Fisheries, my attention was especially called to a whitefish abounding throughout the lake and having considerable commercial value in places, which was well known to fishermen and residents along the lake shore and designated by special names, but which did not appear to have received the notice of ichthyologists and was apparently different from any of the described whitefishes inhabiting this lake. Full notes were taken regarding its abundance, habits, size, and economic importance, but no means were available for preserving specimens, without which a satisfactory determination of the identity of the fish would have been impossible. The following year a good working series of fresh specimens was sent me from two localities in New York and the study of the fish was resumed, with the valuable collections in the U. S. National Museum at hand for comparison. The examination of the whitefishes in that institution has led to the conclusion that the specimens in question from Lake Ontario represent an unrecognized species, and has

disclosed the existence of another related species inhabiting lakes in northern New York that has not heretofore been regarded as distinct.

My studies of these fish have been prompted and much aided by Dr. Tarleton H. Bean, at whose suggestion, and that of Dr. David S. Jordan, president of Leland Stanford Jr. University, whose opinion in the matter was solicited, the writer ventures to call attention to the two fishes in question, to assign to them names, and to note the features that distinguish them from a described species with which they have both been identified, viz, *Coregonus hoyi* (Gill). The opportunity will also be improved to record some original notes on the natural history and commercial importance of one of these.

Figures of the two species regarded as new are presented, and, for purposes of comparison, a figure of *Coregonus hoyi* is given.

Acknowledgment of assistance rendered the writer in the preparation of this paper is respectfully tendered to Prof. Barton W. Evermann, Dr. Theodore Gill, and Mr. Barton A. Bean, in addition to Dr. Bean and Prof. Jordan.

COREGONUS OSMERIFORMIS, sp. nov.

Coregonus hoyi, Bean, Proc. U. S. Nat. Mus. 1882, 658 (Skaneateles and Seneca lakes, N. Y.); Goode, Natural Hist. Aquatic Animals (Seneca Lake, N. Y.), plate only. (Not *Argyrosomus hoyi* Gill).

Body elongate, slender, back not elevated, the greatest depth being considerably less than length of head, and contained 5 times in body length. Head rather large, 4 in body, its width rather more than one-third its length; length of top of head 2 times in distance from occiput to dorsal; profile of head nearly straight. Mouth large, the lower jaw projecting; maxillary contained 3 times in length of head, its posterior edge extending to line drawn vertically through the anterior margin of pupil; mandible one-half the length of head, its angle under the pupil. Eye large, equal to snout, 4 in head. Gill-rakers long and slender, as long as eye, 55 in number, 35 below the angle. Scales small, 83 in lateral line, 9 between dorsal origin and lateral line, 8 between ventral origin and lateral line. Dorsal fin rather high, its height equal to four-fifths depth of body and $1\frac{1}{2}$ times length of base of fin; 9 developed rays; its origin nearer base of caudal than snout; its free margin nearly vertical, straight. Ventrals long, equal to height of dorsal, their length equal to three-fourths of distance from ventral origin to vent; ventral origin midway between base of caudal and pupil; 12 developed rays. Anal with 13 developed rays, the longest four-fifths length of base of fin. Pectorals with 16 rays, longer than ventrals, one-sixth length of body. Teeth present on the tongue. Color above grayish silvery, sides bright silvery, below white; tips of dorsal and caudal dark. Branchiostegals, 7 or 8. Length, 10 inches.

Habitat: Seneca Lake and Skaneateles Lake, New York.

Etymology: *Osmeriformis*, from *Osmerus*, a smelt, and *forma*, form, shape; in allusion to the general shape of the fish. It is known as "smelt" in parts of New York.

The specimens on which this species is based are contained in the collection of the U. S. National Museum; one specimen (No. 32162) is from Seneca Lake, New York, and was collected by Prof. H. L. Smith in June, 1878; the other examples (No. 32165), four in number, are from Skaneateles Lake, New York, and were forwarded by Mr. J. C. Willetts in October, 1882. The foregoing description applies primarily to the specimen from Seneca Lake. The examples from Skaneateles Lake are 5 to 6 inches long; they closely resemble the larger fish but have a somewhat longer head ($3\frac{3}{4}$ or $3\frac{7}{8}$

in length), less depth ($5\frac{1}{2}$ in length), a rather larger eye ($3\frac{1}{2}$ to $3\frac{3}{4}$ in head), the top of head contained $1\frac{2}{3}$ times in distance between occiput and dorsal origin, 2 to 6 fewer scales in the lateral line, and with the dorsal origin rather nearer snout than base of caudal.

This fish more closely resembles *Coregonus artedi* than it does any other known whitefish. The chief points of similarity are the protracted lower jaw and the numerous long gill-rakers. From *C. artedi*, however, it differs in a number of important features, among which the following may be mentioned:

(1) The general form of the two fishes is quite dissimilar, *C. osmeriformis* being much more slender and compressed, with the greatest depth less than length of head, while in *C. artedi* the depth is equal to or greater than head. The ratio of body length to greatest depth is $3\frac{3}{4}$ or 4 to 1 in *C. artedi* and 5 to 1 in *C. osmeriformis.*

(2) The dorsal fin in *C. osmeriformis* is more posteriorly placed, being nearer base of caudal than snout; in *C. artedi* the dorsal origin is nearer snout than base of caudal, or is situated midway between those points.

(3) In *C. osmeriformis* the mandible is longer than in *C. artedi*, being contained twice in head in former and $2\frac{1}{2}$ to 3 times in latter. The maxillary is also longer in *C. osmeriformis;* its length is contained 3 times in head, while in the other species it is contained $3\frac{1}{2}$ times.

This fish differs from *Coregonus hoyi* as described by Jordan * (not as defined by Milner †) in the following essential particulars:

(1) *Coregonus hoyi*, according to Jordan, belongs in the group of whitefishes characterized by an included lower jaw (subgenus *Coregonus*), of which *Coregonus clupeiformis* is the type; *Coregonus osmeriformis* has a lower jaw which projects considerably beyond the upper even when the mouth is closed (subgenus *Argyrosomus*).

(2) *C. hoyi* has a somewhat elevated back and a relatively deep body ($4\frac{1}{3}$ in length); in *C. osmeriformis* the back is not elevated and the body is slender (5 in length.) The general form of *C. hoyi* is that of a herring (*Clupea*); that of *C. osmeriformis* superficially resembles a smelt (*Osmerus*).

(3) Numerous minor differences might be noted. In *C. hoyi* the developed anal rays are fewer (10 instead of 13); the scales are somewhat less numerous (8–77–8 instead of 9–83–8); the origin of the dorsal is nearer snout than base of caudal in *C. hoyi* and nearer base of caudal than snout in *C. osmeriformis*; the eye is contained $3\frac{1}{3}$ times in head in *C. hoyi*, 4 times in *C. osmeriformis.*

This species was first brought to public notice by Dr. Tarleton H. Bean in an article in the Proceedings of the U. S. National Museum for 1882, entitled "Description of a species of whitefish, *Coregonus hoyi* (Gill) Jordan, called 'smelt' in some parts of New York." The paper is based on the specimens in the National Museum, to which reference has been made. The example collected by Professor Smith is described in detail, a table of careful measurements being appended. Regarding this fish Dr. Bean remarks:

> The species is most closely related to *C. artedi*, but differs from it and all other species known to me in many important characters, which have been only vaguely indicated in most of the published descriptions.

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* Manual of the Vertebrates.—American Naturalist, 1875, p. 136.—Also, Jordan & Gilbert, Synopsis of the Fishes of North America.

†Report U. S. Fish Commission 1872–73, p. 86.

Dr. Bean now regards this fish as distinct; he was never fully satisfied with the identification of these specimens with *C. hoyi*, and so expressed himself some years ago. The paucity of material, however, and the somewhat indefinite or confused published descriptions, to which he alludes in the paragraph quoted, deterred him from attempting a final settlement of the question.

COREGONUS PROGNATHUS, sp. nov.

Argyrosomus hoyi, Milner, Rept. U. S. Fish Comm., 1872–73, 86. Outer Island, Lake Superior. (Not *Argyrosomus hoyi* Gill.)

Body oblong, much compressed, back elevated, tapering rather abruptly toward the narrow caudal peduncle, the adult fish having a slight nuchal hump as in *C. clupeiformis*; greatest depth $3\frac{1}{2}$ to 4 in body length. Head rather short and deep, pointed, 4 to $4\frac{1}{3}$ in length; greatest width half the length; cranial ridges prominent. Snout straight, its tip on level with lower edge of pupil. Top of head 2 in distance from occiput to front of dorsal. Mouth large and strong; maxillary reaching to opposite middle of pupil, $2\frac{1}{2}$ in head, length 3 times its width; mandible long, projecting beyond upper jaw when mouth is closed, reaching to or beyond posterior edge of eye, $1\frac{3}{4}$ to $1\frac{7}{8}$ in head. Eye small, 5 in head, $1\frac{1}{2}$ in snout, $1\frac{1}{3}$ in interorbital space, $1\frac{1}{2}$ in suborbital space. Gill-rakers slender, about length of eye, 13 above and 25 below angle. Adipose fin the length of eye, its width half its length. Narrowest part of caudal peduncle contained nearly four times in greatest body depth. Dorsal rather high, with 9 or 10 developed rays, the longest one-half longer than base of fin and contained $1\frac{3}{4}$ times in greatest body depth, $3\frac{1}{4}$ times in distance between dorsal and snout, and $1\frac{1}{2}$ times in head; free margin slightly concave; origin midway between end of snout and base of caudal; dorsal base opposite 9 scales. Anal with 10 to 12 developed rays; the longest ray equal to base of fin and two-thirds height of dorsal. Ventrals as long as dorsal is high; their origin midway between anterior edge of orbit and base of caudal. Ventral appendage short, covering about 3 scales. Pectorals as long as ventrals. Scales rather large, about 75 in lateral line, 7 or 8 above the lateral line, 7 or 8 below the lateral line. Lateral line straight except at origin, where it presents a rather marked curve. Sides of body uniformly bright silvery, with pronounced bluish reflection in life; the back dusky, the under parts pure white without silvery color. Above lateral line, light longitudinal stripes involving central part of scales extend whole length of body. Fins flesh color or pinkish in life, the dorsal and caudal usually showing dusky edges. Postorbital area with a bright golden reflection. Iris golden, pupil black. Branchiostegals, 8. Average length, 15 inches.

Habitat: Lake Ontario, Lake Michigan, Lake Superior, and doubtless the entire Great Lake basin, in deep water.

Etymology: *Prognathus*, from πρό, before, and γνάθος, jaw; in allusion to the projecting mandible. The fish is called "long-jaw" in lakes Michigan and Ontario.

This species is based on 8 specimens from lakes Superior and Michigan in the collection of the U. S. National Museum and 17 specimens from Lake Ontario in the collection of the U. S. Fish Commission. The examples in the museum are as follows: Seven from Outer Island, Wis., Lake Superior, collected by J. W. Milner (catalogue numbers 10576 and 35344), and one from Petosky, Mich., Lake Michigan, collected by McCormick and Connable (catalogue number 23540). The fish in the possession of the Fish Commission were received in the flesh in 1892. One lot, consisting of 11

examples, was forwarded by Mr. John S. Wilson, of Wilson, N. Y., on April 20; the other, containing 6 specimens, came to hand on June 12, and was sent by Mr. George M. Schwartz, of Rochester, N. Y., at the solicitation of Mr. Frank J. Amsden, of the same place. I also to refer to three examples now in the collection of the Fish Commission obtained by Dr. R. R. Gurley at Nine-Mile Point, New York, in June 1893.

This species is quite different from any other whitefish inhabiting the Great Lake basin. It may be at once distinguished from all the whitefishes known to occur in the United States by the general form of body combined with the very long lower jaw, which is contained less than twice in the length of head and extends backward to or beyond the posterior edge of orbit. It most closely resembles *Coregonus laurettæ* Bean, inhabiting northern Alaska, but is easily distinguished from that species by its more elevated back, greater depth ($3\frac{1}{2}$ instead of $4\frac{1}{5}$), larger head (4 to $4\frac{1}{3}$ instead of 5 in body length), larger mouth, longer maxillary ($2\frac{1}{2}$ instead of $3\frac{1}{2}$ in head), longer mandible ($1\frac{3}{4}$ to $1\frac{7}{8}$ instead of $2\frac{1}{2}$ in head), larger scales, and a number of other features.

From the lake herring (*Coregonus artedi*), with which the fish has some affinities, it differs in general form, greater depth, smaller eye, longer mandible and maxillary, shape of head, rather larger scales, more contracted caudal peduncle, longer ventrals, etc.

Dr. Bean has drawn my attention to the resemblance existing between this fish and the *Coregonus lucidus* of Richardson,* described from Great Bear Lake, Canada, in 1836, and not again detected by ichthyologists until 1893.† The similarity consists chiefly in the long lower jaw, the slender caudal peduncle, and the slight nuchal enlargement. These features appear in the figure of *C. lucidus* in the work cited. The plate is so faulty, however, and so often at variance with the text, that much reliance can not be placed on it. The differences in the two fish, as determined by Richardson's not wholly lucid description, are, in Dr. Bean's opinion, sufficiently marked to establish their specific distinctness. *Coregonus lucidus* is described as having 88 scales in the lateral line, with the thirty-third scale in the lateral series equidistant between end of snout and base of caudal. The scales are thus more numerous than in *C. prognathus*, and the position of the particular scale is widely different in the two fish. *C. lucidus* has the ventrals longer than dorsal, and a ventral appendage eleven-twelfths of an inch long in a fish 18 inches long. The ventrals in *C. prognathus* are equal to dorsal, and the appendage is very short, being less than half an inch long in a fish 15 inches in length. Both the maxillary and mandible are smaller in *C. lucidus* than in the other species.

Notice of this fish was first published by the late Prof. J. W. Milner, by whom it was identified with *Coregonus hoyi* (Gill). In the foregoing remarks on *Coregonus osmeriformis* attention was drawn to some of the characters of *C. hoyi* as understood by Jordan. In order to clearly discuss the various points involved in the description of the fish now under consideration and to show the error into which Milner fell, it is necessary to make a further detailed reference to *C. hoyi*.

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* Fauna Boreali-Americana, part 3.

† See Article 3 in the present Bulletin, by Professor Gilbert, who writes under date of February 21, 1894: "My specimens of *lucidus* are from the type locality, and agree in most points with Richardson's description and figure. The lower jaw does not, however, project, and many other points—to some of which you call attention—show abundant difference from *prognathus*."

In 1870 the late Dr. P. R. Hoy, of Racine, Wis., brought to public notice two apparently new species of whitefish, specimens of which were obtained while experimentally dredging in Lake Michigan, about 16 or 20 miles off Racine, in water from 50 to 70 fathoms deep. The fish were sent to the Smithsonian Institution and were named *Argyrosomus hoyi* and *Argyrosomus nigripinnis* by Dr. Theodore Gill, who, however, published no descriptions of them. In an important paper, entitled "Deep-water fauna of Lake Michigan," read before the Wisconsin Academy of Sciences and printed in the Transactions of the Academy for 1870–72, Dr. Hoy recorded the results of his researches and referred to the former fish as follows:

The *Argyrosomus hoyi* Gill is the smallest of the whitefish so far found in any of the Great Lakes, it being only about 8 inches in length and weighing one-fourth of a pound. The moon-eye, as called by the fishermen, is an excellent panfish, but its small size renders it unsuitable for market. Trout devour large numbers of these little beauties, as they constitute a large share of their food. The moon-eye is only found in water over 40 fathoms.

In a paper by Prof. Milner, entitled "New Species of *Argyrosomus* and *Coregonus*," printed in the Report of the U. S. Commission of Fish and Fisheries for 1872–73, Dr. Gill's manuscript names, *Argyrosomus hoyi* and *A. nigripinnis*, are used. Referring to the former, Milner remarks:

The cisco of Lake Michigan, not to be confounded with the cisco of Lake Ontario, is a fish frequenting the deep waters. It is taken in considerable quantities, at depths of from 30 fathoms to 70, and is the principal food of the salmon or mackinaw trout. Specimens were sent to the Smithsonian Institution, in 1870, by Dr. P. R. Hoy, of Racine, Wis., obtained in that vicinity, from which Dr. Gill made diagnostic notes, and adopted the name *Argyrosomus hoyi*. In a list of species of Lake Michigan, published in the Transactions of the Wisconsin Academy of Sciences, Dr. Hoy included Dr. Gill's manuscript name.

Milner further states that in 1871, while engaged in work for the U. S. Fish Commission, he collected numerous specimens of this species (locality not given, but presumably Lake Michigan), which were lost in the Chicago fire. In 1872 he obtained specimens in Lake Superior, one of which, now in the U. S. National Museum (No. 10576), from Outer Island, Wisconsin, he describes in detail; the fish, which is 11½ inches long, agrees perfectly with examples from Lake Ontario, a figure of one of which accompanies this paper. There is no doubt that the fish collected by Dr. Hoy, for which Dr. Gill proposed the name *Argyrosomus hoyi*, are very different from those which Milner had in hand when he prepared the article mentioned. It seems strange that in what purported to be the first published description of the fish Milner should not have consulted the specimens on which the species was based.

In a letter dated December 26, 1893, Prof. Jordan writes as follows regarding the true *hoyi* and the fish described as such by Milner:

It is evident that the *hoyi* of Gill is a very different fish from the other, having no particular relation to it. The description of *hoyi*, in the Synopsis, was taken from the specimen sent by Dr. Hoy. I do not know whether any part of Milner's account was mixed with it or not; I think not. The fish Hoy sent has the lower jaw included, the snout decurved, rather short gill-rakers, and is, I think, a typical *Coregonus* rather than an *Argyrosomus*. The other fish bears more or less resemblance to *laurettæ*, but is probably a new species.

It will thus be seen that an interesting question of nomenclature, involving the two species, is raised, and its settlement becomes necessary. It would seem that if Milner's use of the name *hoyi* in the report referred to was the first appearance of the name in print, it must be retained for the fish described by him, notwithstanding the misapplication of Dr. Gill's name.

The first printed reference to the name *hoyi* was in the paper of Dr. Hoy, previously quoted, in the Transactions of the Wisconsin Academy of Sciences for 1870–72, published in 1872. No description of the fish was given. The first use of the name *hoyi*, accompanied by a description of the fish so named, appeared in an article by Prof. Jordan, on the sisco of Lake Tippecanoe, in the American Naturalist for March, 1875. While the description consists, for the most part, of a comparison between *hoyi* and *sisco*, it is, in the opinion of Prof. Jordan, sufficient to retain the name for that species, provided the principle of priority is not infringed. The question is whether the use of the name *hoyi* by Milner, applying, as it did, to a different fish from that to which the name was attached by Dr. Gill, antedated the article by Prof. Jordan, in which the name was correctly employed. As bearing on this matter, the following extract from an interesting letter from Prof. Jordan, dated December 23, 1893, may appropriately be quoted:

> The name *hoyi* was given by Gill without description to the two little fishes from Racine. At the same time I was at work on the *sisco* of Lake Tippecanoe and I wrote to Dr. Hoy to get me specimens of *sisco* from Lake Geneva. In sending these to me, in 1874, Dr. Hoy also sent me a specimen like those he sent to Gill of the little lake moon-eye to which Gill gave the name of *hoyi*. Of my specimens I published a short account in connection with *sisco* in the American Naturalist for March, 1875, p. 136. This description was reprinted with other matter in the report of the fish commissioner of Indiana for 1875. My little account, which is, however, long enough to hold the name of *hoyi* for the species to which it refers, was the first printed reference to the species, so far as I know at this time. In the U. S. Fish Commissioner's report for 1872–73, ostensibly issued in 1874, but not coming into my hands, as I find from my records, until some time after my paper was printed in 1875, Milner described his fish from Outer Island. I noticed sometime ago that his description did not agree with mine very well, but I presumed that he knew the fish of which he wrote and referred to the same one. So far as I can see, if my description was really first, as I suppose, the name *hoyi* must go with type. If, however, Milner's paper comes first, then the question arises whether *hoyi* should go with Milner's fish or the fish Milner thought he had.*

Prof. Jordan's surmise as to the date of issuance of the Fish Commission report in question is borne out by all the information obtainable at this time. The report was certainly not issued in 1874. The copy for some of the illustrations was not submitted to the Public Printer until January 28, 1875, and the indications are that the report was not printed before May or June, 1875. We are, therefore, justified in continuing to associate with the name *hoyi* the fish for which Prof. Gill proposed that designation.

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* The type specimens of *C. hoyi* in the U. S. National Museum (No. 8902), two in number, are in a poor state of preservation, and it is impossible, at this time, to determine the exact morphology of their heads and fins. The accompanying figure of the species, based on these specimens, is therefore possibly subject to slight corrections, although it agrees with Prof. Jordan's description in the American Naturalist (1875) of an example of this fish then before him, sent by Dr. Hoy: Depth $4\frac{1}{2}$, head 4, eye $3\frac{1}{2}$. Lower jaw much shorter than in *Argyrosomus sisco*, almost *Coregonus*-like in this respect. Maxillaries stronger than in *sisco*, $2\frac{3}{4}$ in head. Mandible 2 in head. Distance from occiput to tip of snout contained $1\frac{1}{3}$ times in distance from occiput to dorsal origin. Scales in lateral line, 75. Depth of body at vent $6\frac{3}{4}$ times in body length. Distance between vent and rudimentary caudal rays $4\frac{1}{2}$ times in length of fish. Head thickly punctate with small black dots. Scales with a peculiar rich silvery color. Length rarely exceeding 7 inches.

Professors Jordan and Gilbert, in the "Synopsis," give the following additional features of *hoyi*, based on the example previously referred to: Body rather elongate, compressed, the back somewhat elevated. Head rather long, intermediate in form between *Coregonus* and *Argyrosomus*. Mouth rather large, terminal, the lower jaw evidently shorter than upper, even when mouth is open; tip of muzzle rather bluntly truncate; maxillary reaching to opposite middle of pupil; mandible extending to posterior margin of pupil. Dorsal 10, anal 10.

NOTES ON THE NATURAL HISTORY AND ECONOMIC VALUE OF COREGONUS PROGNATHUS, WITH SPECIAL REFERENCE TO LAKE ONTARIO.

A few notes based on original observations and inquiries can be submitted regarding the habits and importance of this fish; they relate chiefly to Lake Ontario, where the fish is of considerable commercial value. The writer is indebted to the following gentlemen for interesting information concerning the fish, based on their personal experience: Mr. John S. Wilson, Wilson, N. Y.; Mr. Charles H. Strowger, Nine-Mile Point, N. Y.; and Mr. B. E. Ingersoll, Oswego, N. Y.

In a paper* on the fisheries of Lake Ontario, issued in 1892, the writer drew attention to this fish, but erroneously, although dubiously, referred to it under the name *Coregonus hoyi*. In an earlier report,† relating to the fisheries of the Great Lakes in 1885, the fish under discussion was also mentioned by its common names, without any attempt to identify it scientifically.

COMMON NAMES.

There are at least ten common names given to this fish in Lake Ontario and Lake Michigan. Some of these are of local application; others are quite generally employed.

In Lake Michigan, the most common name in present use is "long-jaw," which is heard along both sides of the lake, but most frequently in localities having steamers employed in the deep-water gill-net fishery. In places in this lake it shares with *C. artedi* the name "herring."

In Lake Ontario this fish, whenever taken, is distinguished by the fishermen from the other *Coregoni*, and has received numerous names in different parts of the lake. In the eastern end, in Jefferson County, the name "bloater" is in general use. At Oswego and along the adjacent shores the name "long-jaw," "bloater," "bloater whitefish," "silver whitefish," and "Ontario whitefish" are employed. Mr. Ingersoll, of Oswego, states that in the New York market the fish is called "siscowet" or "ciscoette," a designation which has been transferred to a few places on Lake Ontario. In Niagara County the names "long-jaw" and "cross whitefish" are in common use, the latter expressing the current opinion among some fishermen that the "long-jaw" is a hybrid between the common whitefish and the cisco, or lake herring. Owing to the relative scarcity of the latter and the abundance of the other whitefish at Wilson, in Niagara County, some of the fishermen call the latter the "cisco," although they do not fail to distinguish it from the regular lake herring. Mr. Wilson states that "long-jaw" is the name generally employed in that locality. This, it would seem, is perhaps the most appropriate common name given to the fish.

The origin of the name "bloater" or "bloater whitefish" can no doubt be traced to the swollen appearance of the abdomen when the fish are brought up from deep water, owing to the expansion of the air bladder under the diminished pressure near or at the surface. All of the fresh specimens examined by me have had the appearance of being greatly enlarged with ripe spawn, and the swimming-bladders were found to be distended. Mr. Strowger states that in the few instances in which he has noticed fish caught in comparatively shallow water there were no signs of bloating.

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* Report on an Investigation of the Fisheries of Lake Ontario. Bulletin U. S. Fish Commission, 1890, p. 207.

† Review of the Fisheries of the Great Lakes. Report U. S. Commissioner of Fish and Fisheries for 1887, p. 316

SIZE, HABITS, ABUNDANCE, ETC.

The average length of the fish seems to be about 15 inches, although it reaches a much larger size. In the series of specimens at hand the females have a somewhat greater length than the males, the averages being 14·96 inches and 14·40 inches, respectively. The largest female is 15·25 inches long and the smallest male is 13·37 inches long. The extremes of weight are 443 and 602 grams for females, and 402 and 473 grams for males, the averages being 508 and 447 grams, respectively.

The average weight of the fish caught in Lake Ontario at the present time is about 1¼ pounds. The smallest taken by the fishermen are under a quarter of a pound. The largest of which a definite record has been obtained weighed 5¼ pounds and was caught off Wilson, N. Y., as I am informed by Mr. Wilson, of that place. Mr. Strowger, of Nine-Mile Point, has seen long-jaws that weighed upwards of 4 pounds and has heard of some weighing as much as 6 pounds. In recent years the use of small-meshed gill nets has reduced the size of the fish taken. The range in weight of marketable fish is now ½ of a pound to 2 or 3 pounds.

The information at hand concerning the movements of the long-jaw whitefish in Lake Ontario goes to show the existence of a definite bathymetrical migration, which depends chiefly on the seasons and is well recognized by most of the fishermen. In winter the fish are found in the deepest water of the lake, at a depth of 400 to 700 feet. Towards spring they begin to approach the shores, being taken at a gradually decreasing depth until August, when they occur in water about 20 fathoms deep. After this time they begin to work out toward the middle of the lake, and by the end of November or the beginning of December they have reached a depth of 45 or 50 fathoms. In the opinion and experience of Mr. Wilson and other fishermen of the western end of the lake, the process of spawning then supervenes, after which the fish retire to the deepest water, where the winter is spent. During the period of spawning the fishermen of Niagara County find that the fish are apparently more plentiful than at other times, the largest catches being then made; this is because the fish scattered over large areas are drawn together by the reproductive instinct and resort to special grounds, where they are found in more compact bodies.

There is a gravelly area off Wilson on which the fish congregate for the purposes of spawning.

Concerning the specimens which Mr. Wilson forwarded, he states that they were taken April 18 in water 50 fathoms deep. At that time of the year the schools are usually more scattered than at other seasons and fewer fish are caught in a given time in a given amount of netting. This dispersion seems to be due to the fact that the fish are quite voracious after their sojourn in the deep water and are obliged to distribute themselves over a wider area in order to secure the necessary supply of food.

Under date of May 17, 1892, Mr. Strowger writes that the first fishing boat to come from the lake that season arrived on that day and had two bloaters, taken about 2 miles from the shore, inside the main schools, which are usually found in 80 to 100 fathoms of water off that place. One of the bloaters had ripe spawn, the other very immature spawn-sacks. In the opinion of Mr. Strowger, this species probably has a prolonged spawning period, extending over the entire year, a view which is plausible enough and in harmony with the known habits of certain other salmonoid fishes inhab-

iting deep water. At the same time, it is no doubt possible, and even probable, that most of the fish spawn in the early winter, like the common whitefish, as observed by Mr. Wilson. The condition of the ovaries in the specimens sent in April by Mr. Wilson indicates the completion of spawning some months before. The ova in the 7 examples examined were uniformly hard, white, and immature, and about one-fortieth of an inch in diameter. In one specimen, 14½ inches long and weighing 531 grams, the ovaries were 5 inches in length and had a combined weight of 17 grams, the left organ being considerably fuller and weighing 9½ grams.

Several of the specimens forwarded by Mr. Schwartz on June 13, 1892, which had probably been caught about two days before, had fully matured spawn, which was running when the fish were unpacked. One of these, 12 inches long, contained 2 ounces of ripe eggs and also many undeveloped ova of very small size, together with a number of larger eggs that were apparently approaching maturity. The ripe eggs were of a pale-yellow color, transparent, and one-sixteenth of an inch in diameter. A careful computation indicated that this fish contained about 15,000 more or less mature ova.

Off the entire shore between Stony Point and the Niagara River, wherever the fishermen set their nets in deep water, the presence of an abundant supply of this whitefish is disclosed. Taking the entire lake into consideration, the fish do not show any marked fluctuations in abundance from year to year, and are now probably as numerous as when the fishery began. Mr. Wilson remarks that appearances would indicate that the fish are less numerous than formerly, but the fishermen think this is not the case, as the fish now go in more scattered schools than in earlier years, probably as a result of the scarcity of food on the regular feeding-grounds.

The largest single lift of which a record has been obtained was made by a crew of Wilson fishermen in 1885; 2 men setting 9 pounds of netting (equivalent to about 140 rods) took 1,600 pounds of these fish in one day. The usual daily catch to a boat is from 200 to 800 pounds.

Comparing the abundance of this whitefish with that of the lake herring, it is interesting to observe that in some places at least, and probably generally, the former is much more numerous. The most pointed information available relates to the experience of the fishermen of Wilson; they often find the ciscoes on the same grounds as the long-jaws, but they are very scarce now and appear to have been affected, like the whitefish, by the advent of the long-jaws. Of the total quantity of long-jaws and ciscoes annually taken there, the former represent no less than 90 per cent.

Very little definite information bearing on the subject of the food of this whitefish can be given. It may be safely surmised, however, that it has substantially the same food as the common whitefish, although its deep-water habits would no doubt afford a different series of animal and vegetable food organisms; and its larger mouth and more powerful jaws indicate a somewhat wider range of food than is possessed by the common whitefish, in which respect it resembles *Coregonus artedi*. The digestive tracts of the specimens at hand contain nothing, but this proves little, as an examination of fish stomachs, unless undertaken soon after the fish are caught, usually fails to be satisfactory, as the intestinal and gastric juices continue their action after the death of the fish and the stomach contents are often completely digested in a short time. Mr. Wilson states, as a result of his personal observation, that the food

of the long-jaws examined by him has consisted mostly of a small crustacean, resembling a crab, with a soft shell. This is probably a *Mysis*.

One of the most interesting and important questions suggested by the presence of this whitefish in Lake Ontario in large numbers is the relation which it may have to the present scarcity of the regular whitefish. It is no doubt possible that the uninterrupted increase of this prolific fish during a long period of years might finally have resulted in the depletion of the natural-food supply of the whitefish to such an extent that the common whitefish, being numerically and physically weaker, were forced to seek other feeding-grounds, which may have been much restricted and in such situations that it was taken by man more easily than formerly, and so more rapidly caught up. The exhaustion of the food would also affect unfavorably the growth and survival of young whitefish. Mr. Wilson's observations confirm this theory; he states that the first year after the appearance of the long-jaws the regular whitefish, which had been abundant, became very scarce, and at the present time are so rarely taken as to be almost a curiosity, the explanation assigned by him and others being that both fish fed on the same food, on the same grounds, and at the same time.

In some of the specimens of this whitefish at hand parasites have been found, to which reference may appropriately be made, although the unfamiliarity of the writer with the subject precludes an entirely satisfactory discussion of the animals in question. In the gill cavities of a number of the fishes received from Wilson, N. Y., in April, small crustaceans about one-half of an inch long, belonging to the order of copepods, were discovered fastened to the gill arches and the under surface of the opercle. Some of the parasites were sent to Prof. R. Ramsay Wright, of the biological department of the University of Toronto, who has contributed extensively to the literature of the parasites affecting fresh-water fishes; he courteously examined the specimens and reported as follows:

> I should regard it as identical with the form described and figured by Kellicott (Proc. Amer. Soc. Microscopists, 1878) as the gill herring-sucker, and named *Achtheres corpulentus*. He also figured a *Lernæopoda* from the whitefish, but this agrees with *Achtheres* in the curved egg sacks, stalked sucker, and form. It appears also to have some indications of segmentation in the abdomen, which *Lernæopoda* ought not to have.

Among the matured ova expressed from specimens received in June a considerable number of trematode worms of the genus *Echinorhynchus* were found. As the usual habitat in fishes of the numerous members of this genus is the intestinal tract, it is not probable that these parasites came from the ovary, although found among the eggs.

COMMERCIAL IMPORTANCE AND FOOD VALUE OF THE LONG-JAW WHITEFISH.

Information is lacking to show that this whitefish has ever been a special object of fishery or at present has any commercial importance, except in lakes Michigan and Ontario, although it is probable that additional inquiries will disclose the fact that in the other lakes the fish is caught in greater or less quantities, but is perhaps not generally distinguished from the closely related lake herring.

In Lake Ontario this is now one of the most important commercial fishes. At some fishing centers it is more valuable than all other fish combined. It never approaches near enough to the American shores to be caught in seines or with any of the fixed forms of apparatus, and is taken only in gill nets set at the bottom in deep water.

Owing to the fact that the fishermen and dealers rarely keep records of the quantities of different species caught or handled, only approximate figures can be given, showing the annual catch of this species in Lake Ontario. In the inquiry, during which most of the accompanying notes were obtained, it was impossible to separate the catch of this whitefish from that of the lake herring and other minor whitefishes, about which less is known than regarding the "long-jaw." It may be stated, however, that the approximate yield of this species in 1891 was 250,000 pounds, with a value to the fishermen of $8,100. The catch of regular whitefish in the same year was only 150,000 pounds, worth $7,000. These figures of course apply only to American fisheries.

Mr. Ingersoll, of Oswego, employs the steamer *George H. Haselton* in his business, and, although the vessel is chiefly used to transport fish from the Canadian fisheries of the Bay of Quinte and the Duck Islands, it is sometimes employed for short periods in fishing with gill nets. In 1890 the aggregate catch of whitefish by this vessel was as follows:

Species.	Pounds.	Value.
Common whitefish	2,000	$80
Long-jaw whitefish	17,500	700
Total	19,500	780

These figures illustrate the great relative abundance of the long-jaw, and are no doubt typical of results to be obtained by deep-water gill-net fishing at the present time.

The habit of the fish of frequenting cold, deep water gives the flesh a firmness and flavor which have made it a very highly esteemed food. Many people assert that the superiority of the common whitefish is only slight, and there seems no reason why the difference in the food value of the two species should be marked. As in the case of the common whitefish, the flesh of the long-jaw will soon become soft unless proper measures are taken to preserve it.

Mr. Strowger gives his personal estimate of the edible qualities of this species in the following words:

> When properly cared for on being caught this is a delicious fish. When salted it keeps well and does not lose its freshness when cooked. A great deal of prejudice against the long-jaw is entertained because of the soft and damaged condition in which the fish is usually sold to the consumers. It is a fish that ought to be iced as soon as it is taken from the water and kept cold until used, as it easily softens and on cooking becomes too greasy for ordinary human palates to enjoy. When fresh-caught it is equal in my judgment to any fish for delicacy of flavor. It is a superior fish for baking when of full size, but small-sized fish are always of less value and should not be caught.

In New York City the long-jaw is used quite extensively for smoking and is very popular, as I am informed by Mr. Ingersoll, who has at times shipped one or two tons weekly to smokers. Personal knowledge of the value of this fish in a lightly smoked condition leads me to attest its excellence.

Perhaps no better criterion of the edible qualities can be adduced than the market prices. The wholesale value of this whitefish is as a rule a little less than that of the common species, but in some localities and at certain times the two fish bring the same price.

Inquiries as to the circumstances of the origin of this fishery in Lake Ontario have elicited the information that it was only at a comparatively recent date that the fish assumed commercial importance, and in most fishing centers it has been known only a few years. When the common whitefish was sufficiently abundant in the more accessible portions of the lake, there was little occasion for the fishermen to undergo the additional labor and time required to set their nets in the deeper water, and consequently the species under discussion was very rarely caught; but the continued scarcity of *Coregonus clupeiformis* brought *Coregonus prognathus* into gradually increasing prominence, and at the present time it is an important food-fish at almost every fishing center on the lake, and in 1891 the catch was probably the largest ever made.

Mr. Strowger, who has been familiar with the lake fishes for a great many years, says that long-jaws were not fished for in the vicinity of Nine-mile Point until some time after the civil war. An old fisherman, however, informed him that prior to that time he occasionally took a specimen while fishing for regular whitefish.

The following local newspaper account of the discovery of "a new kind of fish" reflects the current opinion of the fishermen in the western end of the lake, and is additionally interesting because of the information conveyed:

> Gill nets were recently set in 40 fathoms of water 10 miles out from Charlotte in Lake Ontario, with the expectation of taking trout. When they were taken up they were filled with whitefish; not a trout was found in them. This was a great surprise, especially as the whitefish were of a variety called "long-jaws," which had never before been caught in considerable numbers in Lake Ontario. Those which had been taken in this lake before were small, not larger than herring, and nobody seems to have suspected that "long-jaws," like these, weighing from 2 to 5 pounds each, were to be found in these waters. Seth Green thinks that none of these fish have ever been planted in Lake Ontario. There are two kinds of deep-water whitefish, the "long-jaws" and the "black fins," but only the former has been found thus far. Of these, great numbers are caught, an average "lift" being about 800 pounds. The fish are packed and shipped to New York, Buffalo, and other cities besides Rochester, and readily find sale, the demand for them being so great that difficulty is found in supplying the dealers.—(Journal, Lockport, N. Y., November 22, 1887.)

At Wilson, the principal fishing center west of the Genesee River, the fish have been known only ten years. In the fall of 1882 they made their appearance, and some were then taken by Wilson fishermen. Shortly afterward the fishery became regularly established and is now quite extensive and important.

It would seem that the principal factor in the inauguration of the fishery for long-jaw whitefish was the pronounced diminution in the supply of common whitefish, which made it necessary for the fishermen to resort to new grounds in hope of finding that fish. The more or less experimental setting of gill nets in the deeper water resulted in making the existence of the long-jaw more generally known.

In Lake Michigan this fish is found in the deeper water of the southern two-thirds of the lake, and is taken in considerable numbers in gill nets, in conjunction with lake trout, chiefly by the steam tugs operating long lines of netting in deep water. It is usually distinguished by the fishermen from the lake herring or cisco.

2.—EXTENSION OF THE RECORDED RANGE OF CERTAIN MARINE AND FRESH-WATER FISHES OF THE ATLANTIC COAST OF THE UNITED STATES.

By W. C. KENDALL AND HUGH M. SMITH.

The purpose in view in presenting this paper is to direct attention to a number of fishes inhabiting the fresh and salt water of the Atlantic seaboard, the eastern limits of whose ascribed habitat we are able to extend. We record the occurrence of three marine and five fresh-water species at greater or less distances beyond the ranges hitherto given. One of the former belongs to the herring family (*Clupeidæ*) and is a representative of the West Indian fauna; one is a diminutive member of the mullet family (*Mugilidæ*), also belonging in the subtropical region; the third is a gadoid fish with an apparently restricted habitat in the South Atlantic region. Three of the fresh-water fishes are minnows (*Cyprinidæ*), one is a silverside (*Menidia*), and one is a killifish (*Fundulus*). While not strictly comprehended by the title of this paper, we feel warranted in mentioning the occurrence of the Atlantic salmon (*Salmo salar*) in two localities remote from its usual range.

To Mr. Vinal N. Edwards, of the U. S. Fish Commission station at Woods Holl, Mass., the credit is due of collecting the two salt-water fishes whose distribution on our coast was thereby widened. The minnows were contained in a small collection of fishes obtained by W. C. Kendall at his home in Freeport, Cumberland County, Me. The cyprinodont was secured by the same collector in the lake region of eastern Maine, in connection with the investigation of the contiguous waters of the United States and Canada by the International Fishery Commission.

In connection with the presentation of information relating to the occurrence in Maine of the fresh-water fishes mentioned, we desire to lay stress on the very meager attempts to make collections of the fishes of this State and the consequent noticeable lack of published data concerning the ichthyology of eastern New England, resulting in an uncertain definition of the distribution of many of our common species. If we are justified in generalizing from the somewhat limited information at hand, systematic collecting in almost any part of the northeastern States may confidently be expected to yield valuable results bearing on the geographical distribution and variation of a large number of our smaller river and lake fishes. The addition of three species to the fauna of a State by the seining of a pool in one small mill stream argues favorably for similar striking developments in other parts of this region.

1. Chrosomus erythrogaster Rafinesque. *Red-bellied Dace.*

We record the occurrence of the red-bellied dace at Freeport, Me., where it is one of the commonest fresh-water fishes. Numerous specimens were taken in August, 1892, and November, 1893, in the shallow, muddy expansion of a small brook flowing through the dry bed of a mill pond. The fish were in association with *Salvelinus fontinalis*, *Catostomus teres*, *Notropis megalops*, *Rhinichthys atronasus*, *Semotilus bullaris*, *Pygosteus pungitius*, and several other species referred to in this paper.

The range of this fish heretofore given is Pennsylvania to Dakota and Tennessee.*

The examples before us present the following features: Head, $3\frac{3}{5}$ to 4; depth, 4. Eye, 3. Dorsal, 8. Anal, 9. Scales, 80–27; scales before dorsal, 40. Teeth, 4–5. Lateral line absent or developed on 8 or 10 scales. Length, $1\frac{1}{4}$ to 2 inches. Color in spirits: Back, brownish; belly, silvery; a yellowish-brown band, lighter than black, extending along side; this is bordered above and below by a brownish-band, the upper straight, extending from shoulder nearly to base of caudal, becoming interrupted and faint on posterior third of body, the lower decurved and broader, running from eye to base of caudal, where it terminates in a dark spot; a dark band round snout from eye to eye involving tips of upper and lower jaws; a dark dorsal stripe from occiput to caudal, and faint parallel stripes just below.

2. Couesius plumbeus (Agassiz).

Owing to the somewhat confused synonymy and descriptions of *Couesius plumbeus* and *C. dissimilis*, we provisionally identify as the former species a large number of specimens of this genus obtained at Freeport, Me., September 1, 1892, and November 14, 1893. Following is a description of the fish in question:

Body rather robust, its depth $4\frac{1}{2}$ to 5 in length. Head bluntly conic, its length 4 in body; snout rounded. Mouth moderate, terminal, slightly oblique; maxillary not reaching eye; barbels small. Eye large, $3\frac{1}{2}$ in head. Dorsal, 8; inserted behind origin of ventrals, midway between nostrils and base of caudal. Anal, 8. Lateral line decurved; scales crowded anteriorly; 60 in longitudinal series; 11 above lateral line; 6 or 7 below. Teeth 2, 4–4, 2. Color dusky, with a plumbeous lateral band, disappearing in some of the larger specimens; distinct in young, and terminating in a dark spot at base of caudal in some examples; a dark band around snout, continuing as an indistinct stripe under eyes and across opercula; belly, white; dorsal and caudal dusky; anal and ventrals pale; pectorals with distal part dark and base white. Length, 2 to 4 inches.

The following diagnosis of the two species is given by Jordan:†

a. Scales small, about 68 in the lateral line; head 5; depth 5; body rather elongate; mouth terminal .... *plumbeus*.
aa. Scales larger, about 60 in the lateral line; head, $4\frac{1}{2}$; depth, $4\frac{1}{2}$; body more robust; mouth subterminal .... *dissimilis*.

The extent to which the descriptions of these fish are confused may be seen when it is recalled that the types of *C. dissimilis* in the National Museum have a terminal mouth and 68 scales in the lateral line; while of *C. plumbeus*, Professor Agassiz, the describer, says: "The scales are large; we can scarcely count 60 rows from the gills to the caudal."

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* Synopsis of the Fishes of North America.

† Manual of the Vertebrates, 5th edition, 1890.

We have carefully examined the specimens of *C. plumbeus* and *C. dissimilis* in the National Museum, and have instituted comparisons between them and our fish. We assign our specimens to this species chiefly because of the relatively large scales and the terminal mouth; some of the fish before us have as few as fifty-five scales.

We are not aware that this fish has heretofore been detected in any part of the United States east of the Adirondacks. It has recently, however, been taken near St. John, New Brunswick, although specimens from that province in the U. S. National Museum differ from ours, in having a more inferior mouth, smaller head, and much smaller eye. The fish are larger than ours (4 to 6 inches long), and some of the differences noted may be due to this circumstance.

Our fish bears a close resemblance to the species recently described* by Dr. Jordan from the Frazer River, B. C., and named *C. greeni.* The new species differs from the Maine specimens chiefly in having a broader head, a more curved profile, and a smaller eye.

3. Semotilus atromaculatus (Mitchill). *Chub; Horned Dace.*

Western Massachusetts is the ascribed eastern limit of distribution of this common species.† While the closely related fallfish (*S. bullaris*) is known to range as far north and east as Quebec, we are not aware of the reported occurrence of *S. átromaculatus* in any part of Maine, and therefore judge that its recognized habitat is extended by the taking at Freeport, Maine, of many specimens, in September, 1892, and November, 1893. In the mill stream before alluded to, the horned dace was found to be common, in company with the fishes previously named.

4. Clupea pseudohispanica (Poey). *Spanish Sardine.*

The addition of this fish to the fauna of the United States dates from 1882. In March of that year, Prof. Jordan took four specimens at Pensacola, Florida.‡ An example was also obtained later by Mr. Silas Stearns from the stomach of a red snapper caught on the banks off Pensacola.§ The fish is abundant in Jamaica, Cuba, and elsewhere in the West Indies, and its occurrence on the Florida coast was to have been expected and is perhaps not unusual; its small size and its inutility as food, however, put it beyond the notice of our fishermen, and place on ichthyologists the necessity for its detection on our shores. Prof. Jordan states that the resemblance of the fish to the European sardine (*Clupea pilchardus*) is very striking, and that it is consequently known among the Cuban fishermen as *sardina de España.*

On October 3 and 4, 1892, large numbers of these fish were seined along the shore at Woods Holl and Menimsha Bight, Mass., by Mr. Vinal N. Edwards, of the Fish Commission. Numerous specimens then taken are in the collections of the Fish Commission and National Museum. For the purpose of establishing the identity of these fish, we present the following description:

Body elongate, back rather broad and round. Head 4 to $4\frac{1}{2}$ in length; maxillary reaching about to vertical through anterior margin of pupil, $2\frac{1}{2}$ in head; mandible joining preoperculum slightly in advance of pupil. Eye 4 in head, less than snout. Gill-rakers slender, their length about two-thirds diameter of eye, about 45 below the angle of first arch. Depth about equal to length of head. Dorsal origin much nearer

*Proc. U. S. Nat. Mus. 1893, p. 313.

†Synopsis of the Fishes of North America.—Manual of the Vertebrates.

‡Proc. U. S. Nat. Mus. 1882, p. 247. § Ibid., 1884, p. 33.

end of snout than base of caudal; end of fin with a dark tip. Ventrals under dorsal, about midway between base of caudal and end of snout. Scales large, rounded, with a vertical ridge, more persistent than in *C. harengus*, about 45 in longitudinal and 12 in transverse series; 12 or 13 scales in front of dorsal. Dorsal rays about 17, anal 15 or 16. Color above bluish-purple, below uniformly golden, with purplish reflections; head golden. Peritoneum black or dark reddish-brown. Length, $3\frac{1}{2}$ to 6 inches.

The only fishes found in the vicinity of Woods Holl with which this species is liable to be confounded are the sea herring (*C. harengus*) and the summer herring or alewife (*C. æstivalis*). From examples of the former fish of similar size it differs in having a less compressed body, larger scales, weaker and somewhat shorter lower jaw shorter maxilla, and anterior position of dorsal; the coloration is also different.

In the description of this species in the Synopsis and the Proceedings of National Museum, to which reference has been made, the head is said to be contained $4\frac{1}{6}$ to $4\frac{1}{3}$ times, and the depth 5 to $5\frac{1}{3}$ times, in length. In the foregoing description we have noted the fact that in the Massachusetts specimens the depth is about equal to head. In the smaller fish the body is rather more slender than in the larger specimens (6 inches), and the depth is slightly less than or equal to the length of head; the larger fish have a relatively deep body, the depth is rather more than head, and is contained $3\frac{3}{4}$ to $4\frac{1}{2}$ times in body length. Specimens in the National Museum from Cuba (No. 33126) collected by Prof. Poey, the describer of the species, are similar to those we have in hand in having the depth equal to the length of head. Prof. Jordan also states that the peritoneum is pale; in all our specimens and in the examples from Cuba it is dark. With these exceptions, the fish from the Woods Holl region agree perfectly with the descriptions. Those from Pensacola, on which Prof. Jordan's descriptions are probably based (Nat. Mus. No. 30820, Jordan & Stearns, collectors), are considerably mutilated and much bleached, a circumstance which may account for the discrepancies noted.

5. Salmo salar Linnæus. *Atlantic salmon.*

The normal southern coast-limit of this fish in recent times is given by authorities as southern New England. Dr. Goode, in his standard treatise on "American Fishes," refers to the range as follows:

> The Connecticut River once teemed with them, and stragglers have been captured in the Housatonic and the Hudson. The southern limit is marked approximately by latitude $41\frac{1}{2}°$, but they may be regarded as partially acclimated, through the efforts of the Fish Commission, in the Delaware and in the Susquehanna, which flows into the Atlantic in latitude 37°, and individuals have even been taken in the Potomac River and in North Carolina.

Since the publication of Dr. Goode's work the Hudson River has yearly had a larger run of salmon, until in 1893 between 800 and 1,000 adult fish, some weighing 25 pounds, were reported to have been caught, and the impression prevails that in a few years the fish will become so abundant under proper legal restriction that a regular fishery may be established. This noticeable result has been achieved through the planting of young salmon in the Hudson by the U. S. Commission of Fish and Fisheries.

As a meager contribution to the subject of the pelagic and coastwise distribution of the salmon, the following note is presented:

About April 10, 1893, Capt. Solomon Jacobs, of the mackerel schooner *Ethel B. Jacobs*, of Gloucester, Mass., while cruising for mackerel off the coast of the Middle Atlantic States, made a set at night in a large school of mackerel about 50 miles ESE.

from Fenwick Island light-ship (located about 10 miles off the Delaware coast), and secured among the mackerel an Atlantic salmon weighing 16 pounds, which fish was sent home to Gloucester. Capt. Jacobs, who communicated this information, says the fish was fat and in fine condition. Some of the crew of the vessel told the captain that there was another salmon which escaped over the cork-line while the seine was being "dried in."

Dr. Goode, in the paragraph quoted, mentions the capture of salmon as far south as North Carolina, but we are not aware that the fish has previously been recorded at sea in such a low latitude (38°) as that just cited.

In the Great Lake region, the western or upper limit of the natural range of the salmon is sharply drawn at the falls of Niagara, although in recent years the occurrence of the fish in Lake Ontario has been extremely rare. It was therefore with much surprise and satisfaction that on May 18, 1893, a letter was received from Dr. G. A. MacCallum, the president of the Ontario Fish and Game Commission, dated Dunnville, Ont., May 16, 1893, recording the capture of a salmon in the Grand River at that place; it had been taken in a seine a few days before.

Immediately upon receipt of this letter Dr. MacCallum was communicated with and requested to obtain the fish in question, if possible, and send the same to Washington. This the doctor was fortunately able to do, and the specimen arrived in good condition on June 5, and was examined by Hon. Marshall McDonald, the U. S. Commissioner of Fish and Fisheries, and Prof. Barton W. Evermann, scientific assistant of the Commission. Inspection of the specimen disclosed its undoubted identity as an Atlantic salmon and opened up an interesting question as to its occurrence in Lake Erie. In transmitting the specimen, Dr. MacCallum wrote that two or three years previously a similar fish was taken in the same stream, and in the summer of 1892 fishermen from Port Maitland sold several lots of them about town; Dr. MacCallum also quotes Mr. S. Wilmot, of Ottawa, as saying that a few years ago some of the same fish were taken in the Saugeen River, Ontario, which flows into Lake Huron, where fry had been planted three or four years before. Dr. MacCallum raised the question as to whether the example obtained by him belonged by descent to the same lot.

Dr. MacCallum describes the fish sent by him as follows: ♀ juv. Length of head, 75 mm.; of body, 355 mm.; of snout to orbit, 20 mm.; of orbit, 16 mm. B. 10, D. 13, A. 12, V. 9, P. 14. Pores, 113. Scales, 25–128–22. Coloration above bluish, but bluish green on head, otherwise silvery with rosy shading. Numerous ×-shaped marks on flanks. Two or three teeth on transverse part of vomer, 8 irregularly disposed in two alternating rows on shaft.

Recurring to the question of the origin of the salmon in this locality, it may be said that while the possibility of such a fish finding its way into Lake Erie from Lake Ontario, by way of the Erie or Welland canals, is to be conceded, the probability of such a thing is very remote. The explanation suggested by Dr. MacCallum is entitled to consideration in view of the easily traversed continuous water-course between Lake Huron and Lake Erie. Mention may also be properly made of the experimental planting of fry of the Atlantic salmon in the basin of Lake Erie by the U. S. Fish Commission. It does not appear from the records, however, that any fry have been deposited since 1876. Tracing the occurrence of the fish to this source, the small size of the specimen would consequently indicate that some of the young fish whose acclimation in the lake was attempted reached maturity and underwent the reproductive process and that their progeny survived.

6. **Fundulus diaphanus** (Le Sueur). *Spring Minnow; Barred Killifish.*

The eastern limit of the range of this species is given as eastern Massachusetts.* We now record the taking by W. C. Kendall of numerous specimens in Washington County, Me., in August and October, 1893. The localities in which the fish was found were Boyden Lake, Pennamaquan Lake, and Grand Lake Stream.

The examples from this region present some features that deserve mention. One noticeable point of difference between them and the typical species is the more elongated body; while the species is usually described as having the greatest body depth contained $4\frac{1}{2}$ to 5 times in the body length, the specimens before us from eastern Maine have the length equal to $5\frac{3}{4}$ or 6 times the depth. The scales in our specimens are also much smaller than in southern and western examples. The scales in this species are given as 40–12 † and 46–12 ;‡ Maine fish, however, have from 54 to 58 scales in the lateral line and 16 in a transverse series. Other morphological features of these eastern fish are not peculiar, the head being contained $3\frac{2}{3}$ or $3\frac{3}{4}$ times in length and the eye $3\frac{1}{2}$ times in head, the dorsal having 13 or 14 and the anal 11 rays. The color differences of the sexes, to which attention has recently been called,§ are well exhibited in the larger specimens.

7. **Querimana gyrans** Jordan & Gilbert.

The discovery of this diminutive species was made by Prof. Jordan at Key West, Fla., in 1883, and the description appeared in the "Proceedings of the U. S. National Museum"‖ for 1884, where the following reference to it is given:

> This little fish was found to be very abundant about the market wharves at Key West, apparently feeding on the waste fishes thrown overboard by the fishermen. None of the many specimens obtained is more than three-fourths of an inch long, nor is it likely that the species attains a much greater size.
>
> The fishes swim about in schools of about 50 at the surface of the water, the school having often something of a rotary motion, like a school of whirligig beetles (*Gyrinidæ*). When so swimming the pale spot on the back is very conspicuous, and the bronze-colored ones (males?) are readily distinguished from the green ones. When alarmed, the whole school sinks to the bottom. All the specimens obtained were dipped up with a pail from the boats.
>
> It is probable that the species obtained at Charlestown, and referred by us to *Querimana harengus*, belonged to this species. Unfortunately they have been destroyed.

In April, 1892, one of the writers found this fish in large numbers in the Albemarle region of North Carolina.¶ In the fresh waters of the Pasquotank River and Edenton Bay it was very abundant; in the Roanoke River one specimen was obtained as far up as Plymouth. In July of the same year one of the writers, while connected with the U. S. Fish Commission schooner *Grampus*, saw an abundance of these fish in the lower part of Chesapeake Bay and took a number of specimens,** which are now before us.

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* Jordan, Manual of the Vertebrates.

† Synopsis of the Fishes of North America.

‡ Manual of the Vertebrates.

§ Notes on a Collection of Fishes from the Lower Potomac River, Maryland. By Hugh M. Smith, M. D. Bulletin U. S. Fish Commission, 1890. Also, Fishes of Pennsylvania. By Tarleton H. Bean, M. D.

‖ Descriptions of Ten New Species of Fishes from Key West, Florida. By David S. Jordan and Charles H. Gilbert.

¶ Report on a Collection of Fishes from the Albemarle Region of North Carolina. By Hugh M. Smith, M.D. Bulletin U. S. Fish Commission, 1891.

** Ibid, p. 192, footnote.

We are now able to extend the range of this species much farther north and east, namely, to Woods Holl, Mass. Among a collection of fishes made at that place by Mr. Vinal N. Edwards, of the U. S. Fish Commission, and recently forwarded to Washington, are three specimens of this mullet taken July 1, 1892. The fish are typical in all respects. They are about $1\frac{1}{8}$ inches long and present the following features: Head, $3\frac{1}{2}$; depth, $3\frac{3}{4}$; dorsal, IV–I,7 (or 8); anal, II,9 (or 10); scales, 28 to 30.

The National Museum also contains numerous specimens of this fish from Woods Holl, collected several years ago.

8. Menidia beryllina (Cope). *Silversides.*

This fish, originally described from the Potomac River at Washington, in 1866, was for a long time known only from that locality and from a single specimen. At the time of the issuance of the fifth revised edition of his "Manual," in 1890, Prof. Jordan had knowledge of only the type example. The fish, however, is not uncommon at Washington; and in the Lower Potomac, where it is found associating with *M. notata*, it is quite abundant.* According to Dr. Tarleton H. Bean,† it probably occurs in the Susquehanna River, but as yet it has not actually been observed there. In 1892 the range of the fish was extended in a southern direction by its capture at a number of places in Albemarle Sound, North Carolina, by one of the writers.‡

There is in the collection of the U. S. Fish Commission a large number of specimens of this fish from Eel Pond and other places in the vicinity of Woods Holl, Mass., and from the Acushnet River, at New Bedford. They were taken in company with *Menidia notata*, and appear to be more numerous than the latter species in some localities. Examples from the Acushnet River are larger and darker in color than those from Woods Holl. The specimens vary in length from 2 to $3\frac{1}{4}$ inches. The head is contained in the length without caudal from 4 to $4\frac{1}{2}$ times; the depth is contained in length from $4\frac{1}{2}$ to 5 times; the dorsal formula varies from V–I,8, to V–I,11, the most common number of spines and rays being V–I,9; the anal formula is I,15, I,16, or I,17. Scales, 38 to 41 in lateral series, 8 in transverse series.

9. Phycis earllii Bean. *Earll's hake.*

This species was first brought to public notice in 1880 by Dr. Tarleton H. Bean, who based his description on three specimens obtained in the Charleston, S. C., market by Mr. R. Edward Earll. So far as we are informed, this fish has not up to this time been recorded from any locality north of Charleston. We therefore deem the circumstance of its occurrence nearly three degrees further north worthy of mention. On December 13, 1890, a party from the U. S. Fish Commission steamer *Fish Hawk* landed at Hatteras Inlet, N. C., and found among the eelgrass on the beach inside the inlet a variety of fishes that had been left by the receding tide; among them were eels (*Anguilla chrysypa*), whiting (*Menticirrhus alburnus*), butterfish (*Stromateus alepidotus*), sea-robins (*Prionotus tribulus*), killifish (*Fundulus majalis*), and a live example of *Phycis earllii*, which was obtained and identified by W. C. Kendall. This specimen was somewhat larger than the types, being about 18 inches long; the fishes on which the species was founded were 13 to 14 inches in length.

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* Notes on a Collection of Fishes from the Lower Potomac River, Maryland.

† Fishes of Pennsylvania.

‡ Report on a Collection of Fishes from the Albemarle Region of North Carolina, pp. 192, 195.

3.—NOTES ON FISHES FROM THE BASIN OF THE MACKENZIE RIVER IN BRITISH AMERICA.

By CHARLES H. GILBERT,

Professor of Zoology in Leland Stanford Junior University.

The following notes are based upon a small collection of fishes from the Mackenzie River, British America, recently presented by Miss Elizabeth Taylor to the Museum of the Leland Stanford Junior University.

Coregonus kennicotti Milner.

The single specimen is a skin in good condition, from the Delta of the Mackenzie River (No. 808, L. S. Jr. Univ. Museum). Length 62 cm. This species is in many respects midway between *Prosopium* and *Coregonus*. The gill-rakers are short and few in number, but are slender. The preorbital is very long and narrow, its width less than diameter of pupil. The maxillary is comparatively long and the supplemental bone broad and ovate. Thus the gill-rakers are about as in *quadrilateralis* and other species of the section *Prosopium*, while all the other characters given ally the species with *clupeiformis* and the rest of the *Coregonus* group.

The head is very blunt, the premaxillaries wide and vertically placed. The mouth is inferior, with the high blunt snout but little projecting. The maxillary reaches slightly beyond the vertical from front of eye; its length, measured from its anterior articulation, equals length of snout, and is contained $4\frac{2}{5}$ times in the head (=4 in head when measured from tip of snout). Maxillary broadly ovate, apparently slenderer than in *C. richardsoni* as figured by Günther, and with different outlines. Preorbital narrow, its greatest width contained 5 times in its length and $3\frac{1}{2}$ times in diameter of eye. Eye moderate, shorter than snout, $5\frac{1}{2}$ in head, $1\frac{4}{5}$ in interorbital space. Width of supraorbital bone two-fifths its length. Gill-rakers short and slender, tapering to a slender flexible point; the longest is three-fourths diameter of pupil; six are developed on vertical limb, and fourteen on horizontal limb, of outer arch. Hyoid bone with a round patch of weak bristle-like teeth. These are very similar to those found in *Stenodus*, and are disposed in longitudinal series. The vertical height of head at nape is less than length of head by one-half diameter of eye. Head small, $5\frac{2}{3}$ in length to base of caudal; depth about $4\frac{2}{3}$. Distance from tip of snout to nape one-third distance from nape to front of dorsal.

Front of dorsal nearer snout than base of median caudal rays by length of snout and eye. Adipose fin large, a wide strip at base covered with small regularly imbricated scales. It is inserted over last rays of anal, extending but slightly behind last

anal ray. The ventrals reach halfway to front of anal. The height of dorsal equals length of head without snout.

Scales small, adherent, very regularly imbricated. Lateral line 90 on one side, 87 on the other; 11 scales in an oblique series between front of dorsal and lateral line. D. II, 11–; the last ray split. Anal I, 14.

The color must have been very dark in life. Fins all blackish; in spirits with a bluish tinge. Traces of what may have been blackish spots and vermiculations are discernible on basal portion of dorsal and anal fins. Miss Taylor kindly writes me concerning the color of this species in life:

> The Delta whitefish was far less silvery than other species of whitefish, with fawn color or brownish tints upon it. The scales, too, were sharply defined with a brownish line, almost as if a fine brown netting had been placed around the fish.

Concerning one of the types of *C. kennicotti* (No. 8971, U. S. Nat. Mus., Fort Good Hope, British America), Prof. B. W. Evermann sends me the following notes:

> This specimen is a skin 21 inches long. Length of head, $3\frac{1}{2}$ inches; tip of snout to end of maxillary $\frac{13}{16}$ inch; diameter of eye (not orbit), $\frac{5}{8}$ inch; length of longest gill-raker, $\frac{3}{16}$ inch. Maxillary contained $4\frac{4}{13}$ times in head; longest gill-raker, $3\frac{1}{3}$ times; width of preorbital, $2\frac{3}{4}$ times in eye. Number of gill-rakers, 7+13. Scales, 10–90–10.

This species seems closely related to *C. richardsoni* Günther, with which it may prove identical. Günther's description (Catalogue of Fishes, VI, 185) includes no account of the gill-rakers, which may be long and numerous, as in *C. clupeiformis*, but indicates a fish with a longer snout and a broader supplemental maxillary bone.

Coregonus lucidus Richardson.

Two specimens from Great Bear Lake River (Nos. 805 and 806, L. S. Jr. Univ. Mus.). They are each 40 cm. long. This species is very close to *Coregonus artedi*, of which it may prove to be a subspecies. As pointed out by Dr. Günther, this northern form differs in its shorter head and smaller eye. It seems also to have the premaxillaries placed at a greater angle than in *C. artedi*. Following is a description of the two specimens:

The body is slender, elongate, the curve of back and belly about equal, the greatest depth exceeding length of head, $4\frac{1}{3}$ to $4\frac{3}{5}$ in length to base of caudal. Least depth of caudal peduncle 27 mm. Head small, 5 to $5\frac{1}{3}$ in length; the snout narrow, almost vertically truncate when mouth is closed, the lower jaw fitting within the upper, but the mouth not inferior. Distance from snout to nape $2\frac{3}{5}$ or 3 in distance between nape and front of dorsal. The head is thus much smaller in one specimen (No. 805) than in the other. Nape little elevated. Mouth oblique, with rather slender maxillary, which extends to a vertical midway between front and middle of pupil, its length from tip to articulation equaling distance from end of snout to front of pupil, and contained $3\frac{2}{3}$ to $3\frac{4}{5}$ in length of head. Supplemental maxillary bone probably broader than in *artedi*, from three-fifths to two-thirds greatest width of maxillary. Suborbitals very narrow, their least width less than diameter of pupil. Eye slightly less than length of snout, its diameter contained 5 times in length of head, $1\frac{1}{2}$ times in interorbital width. Supraorbital bone large, its width $2\frac{1}{2}$ to $2\frac{2}{3}$ in its length. Gill-rakers very long and slender, the longest slightly more than two-thirds length of eye; 16+28 in number in both specimens. Front of dorsal slightly nearer tip of snout than base of upper rudimentary caudal rays. The fins are mutilated, so that their length

can not be given. Axillary scale 22 mm. long. *Adipose fin large, inserted vertically above last anal rays, its height from tip to posterior end of base equaling vertical diameter of eye.

D. III, 12 or II, 11; A. III, 12 or II, 11. Lateral line, 85 to 87; 11 or 12 scales in an oblique series downwards and forwards from front of dorsal to lateral line. Nothing can be made out concerning the original color of these specimens.

Thymallus signifer Richardson.

Three specimens of this form (Nos. 809, 810, and 811, L. S. Jr. Univ. Museum) are at hand from the Mackenzie River near Fort Simpson. They have, unfortunately, suffered much in transportation, but the following points can be verified:

Scales in lateral line 88 or 89, not including the smaller ones on base of caudal. The dorsal fin is very high, and must have been at least two-sevenths length of body, judging from one specimen in which one of the posterior rays remains unmutilated. Spots on membrane of dorsal fin numerous. Traces of 7 rows are visible in the broken fin, and at least 10 rows of spots must have been present. The gill-rakers are short, as usual, the longest equaling diameter of pupil; 12 or 13 are present on horizontal limb of lower arch. Dorsal fin with 22 or 23 rays, including the anterior rudimentary rays.

Stenodus mackenzii Richardson.

One specimen, 83 cm. long, from the Delta of the Mackenzie River (No. 807, L. S. Jr. Univ. Museum).

Head $4\frac{5}{6}$ in length to base of tail; maxillary reaching a vertical behind pupil, its length very slightly more than one-third head. Supplemental bone long and narrow, nearly as wide as the maxillary, the anterior end notched, the angle above the notch sharply pointed, the lower angle bluntly rounded.

The teeth are all weak and flexible, bristle-like. They are present in a narrow band in upper jaw, the band extending laterally onto proximal fifth of maxillary. A similar narrow band anteriorly in lower jaw. Very broad patches of similar but slightly stiffer teeth are present on tongue, vomer, and palatines. Eye less than snout, 6 in head, nearly equaling the narrow interorbital width. Gill-rakers very stiff and bony, the longest four-fifths diameter of eye; 7 + 17 in number, the one in the angle reckoned with the vertical limb. They bear on their inner margins two rows of very short weak teeth, which do not make them appreciably rough.

Fully developed rays, D. 12; A. 14; Lat. line, 100.

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* The vertical from last ray of anal traverses the posterior third of base of adipose dorsal. This is the only respect in which our specimens fail to agree with Richardson's description. The latter states that the adipose fin is located "about its own breadth posterior to the anal," but this can probably be accounted for by the nature of the type, Richardson's description being taken from a stuffed skin.

4.—AN AMERICAN FISH IN FINLAND.*

BY OSCAR NORDQVIST.
Inspector of Fisheries, Helsingfors, Finland.

One of the most highly esteemed fishes in North America is the so-called black bass, which designation includes two distinct species, namely *Micropterus salmoides* and *M. dolomieu.* The former, in northern localities, grows to a weight of 6 to 8 pounds, but in southern regions reaches 20 to 25 pounds. The latter species usually weighs only 2½ to 3 pounds, but in exceptional cases reaches 8 pounds, and somewhat more. Both species are distinguished for their firm and savory flesh, and are also highly prized as game fish, which take the fly like salmon and trout. They were introduced ten years ago by the well-known fish-culturist, Max von dem Borne, into Germany, where they are kept in ponds. In Germany the larger species has been called trout bass and trout perch, and the smaller species black bass and black perch, which names have been employed also in the Swedish fish literature. The more rapid-growing trout bass, which thrives in ponds and lakes, has especially been distributed in Germany.

Since the black bass, as appears from the foregoing, is a very valuable fish, I thought it worth the trouble to attempt to introduce it into Finland, and therefore ordered 400 of each kind from Max von dem Borne for the Evois Fishery Experiment Station. I was, however, able to obtain only the trout bass. These were shipped from Berneuchen (near Küstrin, in Prussia) Tuesday afternoon or Wednesday morning, left Stettin Wednesday noon by the steamer *Jakobstad*, and arrived Friday night at 11 o'clock at Helsingfors. When they were examined Saturday morning 59 fish were found dead. From Helsingfors the remaining trout bass were transported to Järvelä (four hours' railroad journey), and from there over 50 kilometers by team to Evois, where, upon arrival at 2 o'clock Sunday morning, they were deposited in a little lake. During the trip from Helsingfors to Evois only 19 fish died. Therefore, of the entire 400 which were shipped from Germany, 322 were planted. Of these fish, which were only six months old, some were 4 to 4⅗ inches long. They were put up in four lots in locked wooden vessels, 100 in each vessel. From Berneuchen to Helsingfors they received no special attention. In Helsingfors and on the way from Helsingfors to Järvelä air was pumped into the water, and on the journey from Järvelä to Evois fresh water was introduced at several stations from brooks and lakes on the route to replace the water which was spilled in transportation.

*En amerikansk fiskart i Finland: Fiskeritidskrift för Finland, etc., No. 11, 1893, pages 161-162. Translated by Tarleton H. Bean.

As the trout bass is a very voracious fish, which should by no means be introduced into any trout waters, it was deposited at Evois in a little lake which has no outflow, and from which, therefore, it can not spread to other waters. The lake in question is about 600 meters long by 400 meters broad, and its greatest depth is 9 meters. The bottom is composed of stone, gravel, and sand, and by means of its banks it is protected from the many sudden gales of the region. The water is very transparent. The lake is very well supplied with perch, roach, and pike, and burbot also are found in small numbers.

[Under date of December 31, 1893, Dr. Nordqvist wrote me from Helsingfors about the later history of the experiment as follows: "About the black bass I can only add that when put in the lake they disappeared in the darkness. When I visited the place the next morning none were seen, so I believe all were alive. If some of them had died, one would, no doubt, have seen them on the bottom, as was the case with some *Coregonus marœna* which were planted some days earlier in another lake also belonging to the Experimental Station. Now the lakes are covered by ice, so I can not get any information about the bass until next summer."—T. H. B.]

5.—TWO FERTILE CYPRINOID HYBRIDS.

BY KARL KNAUTHE.

[Translated from the German: *Zoologischer Anzeiger*, vol. 16, pp. 416–418, October 30, 1893.]

[A hybrid between the common carp (*Cyprinus carpio*) and a species closely related to the goldfish known as the Karausche (*Carassius carassius* or *vulgaris*) is not uncommon in some parts of Germany, and is intermediate between the two in form, squamation, fins, and the pharyngeal teeth. Although generally recognized as a hybrid and known by a name indicating its parentage, a compound of the names of the two parents, Karpf-Karausche (*Karpf*, the true carp, and *Karausche*, the crucian carp), a distinctive generic and specific name (*Carpio kollari*) is given to it by German ichthyologists. No experiments appear to have been made to ascertain the fertility or character of the progeny of these hybrids until lately. The following article, therefore, supplies a want and will be of interest to carp-culturists. There are no records of the occurrence of the so-called *Carpio kollari* in the United States (or indeed of any other cyprinoid hybrids), and attention should be directed to those places where the carp and goldfish commingle.—THEODORE GILL.]

If I am not mistaken there are at present no positive observations that *Carpio kollari* Heck, or any other of the known hybrids between any of our cyprinoids, are fertile. Von Siebold, it is true, long ago found fully developed ovaries in hybrid carps ("Fresh-water Fishes of Middle Europe," Leipzig, 1863), and recently District Magistrate Lambateur reported to Prof. Landois "that the fish spawned in the months of March and April" ("Westfalens Thierleben," Fische, Munster, 1892), yet this eminent zoologist seems to partly doubt the correctness of this observation.

This year, in order to clear the matter up, I have made different experiments with full-grown typical examples of *Carpio kollari*, as well as with *Alburnus leydigii* (*Alburnus lucidus* × *Leucaspius delineatus*) in numerous clay pits of my own make. The pools, perfectly constructed ponds, were protected against ducks, geese, etc., by high barbed-wire fences, had lain dry a long time, and were exclusively stocked with the specimens for experimenting; to these they offered, with a rich food supply, excellent spawning-places.

In the first pit there were put 2 females of *Carpio kollari* Heck and 1 male of *Cyprinus carassius* L.

In the second pit there were put 1 male of *Carpio kollari* Heck and 2 females of *Cyprinus carassius* L.

In the third pit there were put 3 males of *Carpio kollari* Heck and 6 females of *Carpio kollari* Heck.

The spawn was surprisingly sparse and, besides, about 60 per cent of the fry died during the first days of life. (The same occurred this year with the fry of pure carps

and crucians in nearly all the breeding ponds in Schlaupitz.) As a cause of this I would mention the possible effects of an abnormally high temperature after a thorough contamination of the waters by manure during the melting of the snow. The water which filled the pits was supplied from our ponds. The result was, in pit No. 1, 20; in pit No. 2, 15; and in pit No. 3, 25 young cyprinoids; of these, 9 in pit No. 1, 10 in pit No. 2, and 6 in pit No. 3 were genuine crucians; 5 in pit No. 3 were genuine scale carps; the balance were more or less *Carpio kollari* Heck.

A fourth clay pit, also a perfectly constructed pond, was stocked, exactly as stated above, with hybrid carps and scale carps, after it had been divided by high embankments (brick walls) into three approximately equal ponds. Those showed apparently somewhat more offspring than the above-mentioned hybrids, but also in this instance more than one-half was lost, so that I could get out of—

A (2 females of *Carpio kollari* × 1 male of *Cyprinus carpio*)..............30 specimens.
B (1 male of *Carpio kollari* × 2 females of *Cyprinus carpio*)..............50 specimens.
C (1 male of *Carpio kollari* × 4 females of *Carpio kollari*)................20 specimens.

Of these I consider that in A there were 15 specimens, in B 35, and in C 3 that were typical carps; in C there were 5 genuine crucians; the remainder were half crucians in various gradations, but much nearer—in A and B almost without exception—to the *Cyprinus carpio* than to the *C. carassius.*

The experiment with the *Alburnus leydigii* had to be made in "Lund" hatching troughs, as I had to use the other pits for other experiments.

In No. 1 I placed 1 male of *Leucaspius delineatus* and 2 females of *Alb. leydigii.* In No. 2 I placed 2 females of *Leucaspius delineatus* and 1 male of *Alb. leydigii.* I did not have more of these little fish.

Results: In No. 1 there were 60 fry, 51 of which were *Leucaspius delineatus.* In No. 2 there were 40 fry, 34 of which were *Leucaspius delineatus.*

The circumstance is very remarkable that almost all these stock fish, while in all other respects true "Moderrapfen" (*Leucaspius*), inherited the perfect lateral line of *Alb. leydigii*, and in the few others this line reaches quite far back.

I would call the attention of the reader to the fact that years ago I often obtained in the Upper Zobten waters *Leucaspius delineatus* with a perfect lateral line.

Of *Alburnus lucidus* × *Leuciscus erythrophthalmus* as well as *Leucaspius delineatus* × *Leuciscus rutilus* (*Leuciscus carii*) I had only one specimen each; the experiments made with them did not give any results, though I hope in future to also obtain offspring from them. It is true many objections can be made against this latter assumption, as Claus says:

> The hybrids only form intermediate stages with disordered generative organs without prospect for offspring, and even in case of fertility, which was often observed in female hybrids, they revert back to the paternal or maternal species.

SCHLAUPITZ, *August 24, 1893.*

6.—A REPORT UPON EXPLORATIONS MADE IN EEL RIVER BASIN IN THE NORTHEASTERN PART OF INDIANA IN THE SUMMER OF 1892.

By PHILIP H. KIRSCH,
Commissioner of Fisheries for the State of Indiana.

The investigations upon which this report is based were made in the summer of 1892 under the direction of Hon. Marshall McDonald, U. S. Commissioner of Fish and Fisheries. A description of each stream and lake examined is given, with a list of the fishes found in these waters and such notes upon them as seemed to be of special interest. In the prosecution of the work the writer had the assistance of Messrs. C. Myers, Fred Webster, and George Ramp, of Columbia City, Ind., and of Mr. Charles Beeson, a student of Indiana University. For aid received in carrying out the inquiry the writer is under special obligations to Prof. B. W. Evermann, of the U. S. Fish Commission.

The following is a classified list of the waters examined:

The Eel River System.

1. Eel River.
2. Hull Lake, Allen Co.
3. Mud Creek, Whitley Co.
4. Blue River, Whitley Co.
5. Blue Lake, Whitley Co.
6. Thorn Creek, Whitley Co.
7. Round Lake, Whitley Co.
8. Cedar Lake, Whitley Co.
9. Shriner Lake, Whitley Co.
10. Blue Babe Creek, Whitley Co.
11. Meredith Creek, Whitley Co.
12. Stoney Creek, Whitley Co.
13. Spring Creek, Whitley Co.

The Eel River System—Continued.

14. Wilson Lake, Whitley Co.
15. Sugar Creek, Whitley Co.
16. Whistler Creek, Whitley Co.
17. Squirrel Creek, Wabash Co.
18. Paw-paw Creek, Miami Co.
19. Flowers Creek, Miami Co.
20. Weasaw Creek, Miami Co.
21. Twelve-mile Creek, Cass Co.

The Tippecanoe River System.

1. Loon Lake, Whitley and Noble counties.
2. Big Lake, Noble Co.
3. Crooked Lake, Whitley and Noble counties.

EEL RIVER SYSTEM.

Eel River with its tributaries drains a scope of country in northeastern Indiana lying between the basin of the Wabash River on the southeast and that of the Tippecanoe River on the northwest, and extending from the St. Joseph River basin, near Fort Wayne, to Logansport. This river basin has an average width of about 18 miles and a length of 72 miles. The surface of the region through which it flows is generally rolling and everywhere covered with glacial drift except in a limited area near Logansport where bed rock is exposed.

The mean temperature at Columbia City for a period of six years was 49·5°.* The highest temperature at this place in the summer of 1892 was 94°; and the lowest temperature the past winter was on January 15, when the thermometer stood at −17°. During the winter of 1892–93, all the streams and lakes were frozen over, and on quiet waters the ice reached a thickness of about 2 feet. The ice left Blue River during the second week of March. The mean annual rainfall at Columbia City for a period of six years was 35·67 inches. The amount of snowfall during the past winter was 4 feet 8 inches. This was greater than for any winter during the eight preceding years.

The bottom lands along the streams are mostly covered with forests of oak, elm, maple, beech, hickory, and sycamore. Occasionally, along their upper courses, the streams are skirted with willows and a thick growth of underbrush.

The water in the lakes and streams is rather clear, and where there is sufficient depth an abundance of fish is found. These waters need not be stocked with new kinds of fish. They already contain some of the finest game and food fishes found anywhere. It is only necessary that the waters be properly protected, and in a few years they will produce fish beyond all expectation. Large numbers of crawfish, mussels, and various kinds of water weeds are found here.

Investigations in the Eel River system were made on the following streams and lakes:

1. *Eel River.*—The summit north of Wallen, in Allen County, is probably the highest point from which water flows into Eel River. This point has an elevation above sea level of 887 feet. Eel River at Logansport, where it empties into the Wabash River, has an altitude of 583 feet. The river has, therefore, a fall of 304 feet in its total length of 72 miles, or about 4 feet 2 inches to the mile.† The channel of Eel River at North Manchester has an altitude of 721 feet, and the stream from this point to its mouth, a distance of 36 miles, has a fall of 138 feet, or 3 feet 10 inches to the mile. In the upper 36 miles of its course, Eel River has a fall of about 4 feet 7 inches to the mile.

At its mouth, Eel River has a width of 447 feet; the Wabash River just before receiving Eel River is 507 feet wide; and the width of the Wabash immediately below the junction of the two rivers is 527 feet.

The upper 8 or 10 miles of Eel River was formerly very crooked and flowed through low, swampy lands, but within the past three years the channel has been dredged and straightened, in this way redeeming much valuable land. The stream is now shallow, with but few deep holes for fish. The river throughout the remainder of its course is crooked, and the bottom of the channel is of sand and gravel, rarely covered with rocks. There are many deep holes and many gravelly shoals with patches of water weeds. From Adamsboro to Logansport, a distance of 6 miles, the stream has cut its bed into solid limestone (Devonian of the Upper Helderberg Group), and has formed many broad shoals with numerous potholes, and many broad stretches filled with algæ and water weeds.

There are 14 dams on Eel River, about which good game and food fishes are abundant.

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*All temperatures are given in Fahrenheit degrees.

†All the distances are taken in a straight line, not following the bends of the streams.

The following shows the place and time of investigations on Eel River and the location of dams:

a. The upper course of Eel River at six different points, August 1 and 2, from near its source, in Allen County, to the mouth of Blue River.
b. South Whitley, Whitley County, July 19 and 20, 1 dam.
c. Collamer, Whitley County, July 21, 1 dam.
d. Liberty Mills, Wabash County, July 22, 1 dam.
e. North Manchester, Wabash County, August 26, 1 dam.
f. Laketon, Wabash County, July 23, 1 dam.
g. Roann, Wabash County, July 25, 1 dam.
h. Pettysville, Miami County, August 26, 2 dams.
i. Chili, Miami County, July 26 and August 24, 1 dam.
j. Mexico, Miami County, July 27, 1 dam.
k. Dennison's Mill, Miami County, August 25, 1 dam.
l. Adamsboro, Cass County, July 28, 1 dam.
m. Logansport, Cass County, July 29 and 30, 2 dams.

2. *Hull Lake*, in the west part of Allen County. This lake has an area of "about 150 acres"; its banks are low and swampy. The bottom of the lake near the shore is soft muck, and the water has an inky appearance, imparting a dark color to the fishes. This body of water is drained by a small creek which, after meandering in a northeasterly direction for 2½ miles, joins Eel River in Allen County. Collections from this lake were made August 1. Fish are very abundant, but limited in number of species. Only five different species were secured from this lake.

3. *Mud Creek* has its origin in the east part of Whitley County, flows in a general westerly direction, and empties into Eel River on the opposite side and a few rods above the mouth of Blue River. It is fed by living springs, and consequently flows during the severest droughts. This stream was seined August 18, for a distance of 3 miles, in its middle course.

4. *Blue River*, Whitley County, has its source in Blue Lake, near Churubusco. After a general southwest course of about 11 miles it joins Eel River 2½ miles south of Columbia City. The first 2 or 3 miles in its upper course Blue River flows through low, marshy land. Throughout the remainder of its course the channel is in the drift deposits and its bottom is of gravel and occasional long stretches of sand. This is a beautiful stream and well supplied with native fishes. Large numbers of suckers (*Catostomus teres* and *Moxostoma macrolepidotum duquesnei*) were caught with hook and line from Blue River, at Columbia City, from the time the ice left the stream, about March 18, to the last of April. The largest specimen of *Catostomus teres* taken weighed 5 pounds. The mud puppy or water dog (*Necturus maculatus*) was also frequently taken with angle worms, the bait used for suckers. Blue River was examined throughout its course at points not more than 3 miles apart, August 16, 18, and 22.

On May 20, 1893, Blue River, at Columbia City, had an average width of 36 feet, an average depth of 18 inches, and a current of 6⅗ inches per second. This gives a flow of not less than 10,000 gallons per minute. The temperature of the water at 3 p. m. was 70°; of the air, in the sun, 94°.

5. *Blue Lake*, 1½ miles northwest of Churubusco, Whitley County. This lake has a length of 1¼ miles and a width of half a mile, and is said to have a "very uniform depth of 40 to 55 feet." It receives its waters from Upper Blue River, a small stream from Noble County, and from springs along the sides and bottom of the lake. The

bottom of the lake is rather solid, and in the shallower places is covered with a dense growth of water weeds. The outlet of Blue Lake is at its west end and only a few rods from the entrance of Upper Blue River. This beautiful sheet of water was examined June 16 and 17 and August 22. Large-mouthed black bass, blue-gill, ringed perch, and calico bass are found in abundance.

6. *Thorn Creek*, the outlet of Round Lake, flows south 2½ miles and empties into Blue River at Blue River Church. It has a shallow and swift current, with but little deep water for the concealment of fishes. This little stream is chiefly important as a fishway between Round Lake and Blue River, and for this reason it should be kept clear of rubbish and other obstructions that would impede the passage of fish. The specimens noted from Thorn Creek were taken from a point 1½ miles from its mouth, August 16.

7. *Round Lake*, in the northern part of Whitley County, has a length from southwest to northeast of seven-eighths of a mile and a width of half a mile. The greatest depth we found was 63 feet. The bottom is mostly firm, and along the south side it is scattered over with logs; the shore at the northeast end is gravelly. There are many waterweeds in the shallow water. This lake contains an abundance of fish. It has an outlet on its south side into Thorn Creek. Round Lake was investigated August 8 and 9. This is the only water in which *Lepomis heros* was taken.

8. *Cedar Lake* lies immediately west of Round Lake, into which it empties its waters by means of a broad, weedy channel. Cedar Lake has a length northwest and southeast of about 1½ miles and a width of ¼ mile. By numerous soundings we found its greatest depth was about 79 feet. This lake was fished August 10, but on account of the very soft bottom and dense growth of water weeds but little collecting was done.

9. *Shriner Lake*, the last of this beautiful trio of lakes, is parallel to and immediately south of Cedar Lake and west of Round Lake. Shriner Lake has a length of 1¼ miles and a width of ¼ mile. The water is shallow for only a few rods from the shore, when the bottom suddenly descends at a sharp angle to a depth, in some places, of 70 feet. Shriner Lake is fed by springs, and has an outlet through an artificial channel into Round Lake. Forty years ago it had a natural outlet directly into Thorn Creek. This lake was examined June 15, 16, and August 10.

Round, Cedar, and Shriner lakes are well stocked with native food-fishes. Among the most abundant species are large-mouthed black bass, blue-gill, common sunfish, ringed perch, calico bass, and cisco.

10. *Blue Babe Creek*, near Columbia City. This little stream has its rise in the northern part of Whitley County, takes a southerly course, and flows into Blue River about a mile above Columbia City. During long droughts, except in the lower course, it becomes dry on the ripples. Blue Babe Creek is well supplied with fishes, 25 different species being secured in it August 13 by a few hours' seining.

11. *Meredith Creek* is a small stream west of Columbia City; it flows southwest and empties its waters into Eel River about ¾ of a mile below the mouth of Blue River. This stream was examined at a point 2 miles above its mouth August 19. Here the channel has a gravelly bottom covered with innumerable loose rocks. There are many deep holes. The water is cold and clear.

12. *Stony Creek* has its rise in the east part of Whitley County and flows west into Eel River. Except for 3 miles in its lower course, it becomes dry during the summer. The fish from this stream were collected from its lower course August 19.

13. *Spring Creek* has its source in Black and Wilson lakes, in the west part of Whitley County, and it receives many springs along its course. It flows south and empties into the mill pond 1¼ miles above South Whitley. This stream was seined in its lower course (July 20) and upper course (August 15).

14. *Wilson Lake* is 4½ miles west of Columbia City. It has a length northwest and southeast of ½ mile and a width of ¼ mile. The bottom near the shore is soft and overgrown with weeds and the banks are high and gravelly. Wilson Lake has an outlet at the east end into the east fork of Spring Creek. The outlet is at present being deepened, and when this is completed the surface of the lake will be lowered about 6 feet. This lake was examined August 15. Local fishermen report game fish very abundant. On account of difficult seining only a small collection of 8 different species was made. The large-mouthed black bass seems to be the prevailing game fish.

15. *Sugar Creek*, near South Whitley. This small stream has a northwesterly course and pours its waters into the mill pond ½ mile above South Whitley. Sugar Creek was seined near its mouth July 20.

16. *Whistler Creek*, near Collamer, July 21. This stream flows south and empties into the Eel River 1 mile below Collamer. It has a winding course. Its bottom is everywhere smooth and sandy, with many deep holes. Fish are abundant. *Etheostoma pellucidum*, *E. nigrum*, *Moxostoma macrolepidotum duquesnei*, and *Notropis megalops* are the most common species The collection from this stream was made near its mouth. During my work in this vicinity I was materially aided by Mr. M. L. Galbreath, of Collamer, Whitley County.

17. *Squirrel Creek*, near Roann. This stream flows south and empties into the mill pond at Stockdale, 1 mile northwest of Roann, Wabash County. It is a winding stream with sandy bottom, flowing for the most part through low woodland. Squirrel Creek was seined July 25 in its lower course.

18. *Paw-paw Creek.* This stream flows west through Wabash County, and enters the milldam near Pettysville, Miami County. Paw-paw Creek was investigated August 26 for a distance of 1 mile in its lower course. The channel has a gravelly bottom, and the water is clear and cold. *Campostoma anomalum*, *Etheostoma pellucidum*, and *Moxostoma macrolepidotum duquesnei* are especially common.

19. *Flowers Creek* empties its waters into Eel River below the dam at Chili, Miami County. Its bed is of coarse gravel, and the water is cool. July 25 this stream was seined from the railroad to its mouth.

20. *Weasaw Creek.* This stream flows southerly and southwesterly through the western part of Miami County and discharges its waters into Eel River near the town of Denver. About a mile above the junction with Eel River it receives Little Weasaw Creek from the east. The water in these creeks is somewhat muddy and cooler than river water. A few fishes were collected in Little Weasaw Creek in 1877 by Mr. J. C. Cunningham, of Denver, Ind., who has kindly allowed me to include them in the present list.

21. *Twelve-mile Creek*, near Adamsboro. After a general southwest course this stream enters Eel River 2 miles above Adamsboro, Cass County. The bottom of the channel is very rocky and the water is shallow and swift.

FISHES OF THE EEL RIVER SYSTEM.

1. **Petromyzon concolor** (Kirtland). *Lamprey.* One specimen, 6 inches long, was taken from Blue River, at Columbia City, July 14, 1893. Others were seen at the same place.
2. **Lepisosteus osseus** (Linnæus). *Common Gar-pike.* Very common in all the lakes examined. A few small specimens from Blue River were seen.
3. **Amia calva** Linnæus. *Dogfish.* Taken in quiet or sluggish waters in Blue Lake, Eel River, and in nearly all of its upper tributaries.
4. **Ameiurus natalis** (Le Sueur). *Yellow Cat.* Found in sluggish waters. Common in all the lakes.
5. **Ameiurus nebulosus** (Le Sueur). *Common Bullhead.* Common in the lakes. Less common throughout Eel River and its tributaries.
6. **Noturus flavus** Rafinesque. Common in flowing water at nearly all points in Eel River. A single specimen from Twelve-mile Creek.
7. **Noturus miurus** Jordan. Scarce. A few specimens were taken in the middle course of Eel River and one from Meredith Creek.
8. **Noturus eleutherus** Jordan. A number of specimens were secured in the middle course of Eel River. Largest taken, 3¾ inches long.
9. **Noturus gyrinus** (Mitchill). Two small specimens were obtained from weedy bottom, in the upper course of Blue River.
10. **Carpiodes velifer** (Rafinesque). Found by me only in Eel River, below the lower dam at Logansport, where it is very abundant. The largest specimen taken is 9 inches long.
11. **Catostomus teres** (Mitchill). *Small-scaled Sucker; Black Sucker.* Taken in none of the lakes except Round Lake, but it is common in all the streams. One of the commonest of fishes in this region. The largest seen from Blue River weighed 5 pounds.
12. **Catostomus nigricans** Le Sueur. *Hog Sucker.* None were seen in any of the lakes, but they are common in swift waters in all the streams. The largest specimen measured 13 inches.
13. **Erimyzon sucetta** (Lacépède). *Chub Sucker; Sweet Sucker.* Taken in none of the lakes except Round Lake. Very common in Eel River and all its tributaries above South Whitley.
14. **Minytrema melanops** (Rafinesque). *Striped Sucker.* Common in Blue and Round lakes. Less common but also found in all the streams examined. The largest taken is 12 inches long.
15. **Moxostoma macrolepidotum duquesnei** (Le Sueur). *White Sucker.* None were taken in any of the lakes, but it is exceedingly abundant in all the streams. Large specimens were taken with hook and line at Columbia City during March, 1893. The largest seen was about 13 inches long.
16. **Cyprinus carpio** Linnæus. *Carp.* This well-known fish was taken at several points on Eel and Blue rivers. They found their way into the streams from private fish-ponds.
17. **Cyprinus carpio specularis** Linnæus. *Mirror Carp.* A single specimen of about 3 pounds weight was secured in the upper courses of Blue River.
18. **Cyprinus carpio coriaceus** Linnæus. Mr. M. L. Galbreath, of Collamer, Ind., reports having seen one which was caught in Eel River at that place a few years ago.
19. **Campostoma anomalum** (Rafinesque). Taken in all the streams examined. None were seen in the lakes. Mostly found in flowing water.
20. **Chrosomus erythrogaster** Rafinesque. *Red-bellied Minnow.* Taken by Mr. J. C. Cunningham in Little Weasaw Creek, near Denver, Ind. We have no knowledge of this fish having been taken anywhere else in the Eel River basin.
21. **Hybognathus nuchalis** Agassiz. A single specimen, 7 inches long, was taken from Eel River below the lower dam at Logansport.
22. **Pimephales notatus** (Rafinesque). Common at all points in the streams examined. Found in all the lakes except Hull and Blue lakes.
23. **Notropis cayuga** Meek. This minnow was secured in Round and Shriner lakes, from the upper course of Blue River, and in Blue Babe Creek. Nowhere common. Largest specimen, 2⅝ inches long. Head, 4 to 4½ in length of body; depth, 4¼. Eye, about 3¼ in length of head. Mouth somewhat oblique, lower jaw not the shorter. First ray of dorsal nearer tip of snout than to base of caudal fin. Pectoral fins not quite extending to base of ventrals. Lateral line not complete. Scales in lateral line, 36 to 38. The dark lateral bands pass forward through the eyes and meet on the upper jaw in front. D. 8; A. 7 or 8.

24. **Notropis anogenus** Forbes. Found in Blue River and Blue Lake only. Very abundant in the lake, less so in the river. The largest specimen taken has a length of $1\frac{7}{8}$ inches. Head, 4 to $4\frac{1}{4}$ in length of body; depth, 4 to $4\frac{1}{3}$. Eye somewhat longer than snout, and about 3 in length of head. Scales before dorsal, 13; scales in lateral line, 36. Lateral line complete. D. 8; A. 8 (a very few 7). The black lateral bands pass forward through the eyes and across both jaws in front.

25. **Notropis heterodon** (Cope). Taken in Round, Cedar, and Shriner lakes. Common in all these waters. The largest taken, $2\frac{1}{2}$ inches long. Lateral line complete. Lateral bands pass forward through the eyes and meet on both jaws in front.

26. **Notropis deliciosus** (Girard). Found in Eel River from South Whi'ley down to the mouth. Not common. Head, about 4 in length of body; depth, 5. Eye about equal to length of snout and slightly more than 3 in length of head; 13 or 14 scales before the dorsal; 36 scales in lateral line.

27. **Notropis whipplei** (Girard). *Silver-fin.* Very common in Eel River and all its tributaries from Liberty Mills down to the mouth.

28. **Notropis megalops** (Rafinesque). *Common Shiner.* Very abundant in all the streams. Two small specimens from Cedar Lake and three from gravelly bottom in Round Lake. Also a few small specimens from Wilson Lake. None from the other lakes.

29. **Notropis jejunus** Forbes. Taken only in the pool below the lower dam at Logansport on limestone bottom. Very numerous. Head, 4; depth, $4\frac{1}{2}$; D. 8; A. 7. Largest specimen taken $3\frac{3}{8}$ inches long.

30. **Notropis umbratilis cyanocephalus** (Copeland). *Red-fin.* Common. Taken everywhere except in the lakes.

31. **Notropis dilectus** (Girard). Numerous at all points examined in Eel River and its tributaries below South Whitley. A single specimen from the lower course of Blue River. Head, 4 to $4\frac{1}{2}$ in length of body; depth, $4\frac{2}{3}$ to 5; length of eye equal to that of snout, and $3\frac{3}{4}$ in length of head. D. 9; A. 10. Largest specimen taken, $2\frac{3}{4}$ inches long.

32. **Notropis arge** (Cope). Taken in Eel River, from North Manchester to the mouth; also in Pawpaw, Flowers, and Twelve-mile creeks. Scarce. Found nowhere else. Head, $4\frac{1}{2}$ in length of body; depth, $5\frac{1}{2}$; eye slightly longer than snout and 3 in length of head; mouth very oblique, maxillary reaching to front of eye. The front of dorsal is midway between the center of the pupil and base of caudal fin.

33. **Ericymba buccata** Cope. Found nowhere except on rocky bottom on the lower 6 miles of Eel River and in Twelve-mile Creek near its mouth.

34. **Hybopsis hyostomus** Gilbert. A few small specimens only were secured in Eel River, below the lower dam at Logansport. The largest specimen taken is $2\frac{1}{2}$ inches long. Eye $3\frac{1}{2}$ to nearly 4 in length of head.

35. **Hybopsis watauga** Jordan & Evermann. Scarce. The largest specimen $3\frac{1}{2}$ inches in length. On four specimens noted the scales in the lateral line number respectively 42, 46, 48, and 50. On the larger specimens the black spots on the sides have almost disappeared.

36. **Hybopsis amblops** (Rafinesque). Taken in Shriner and Cedar lakes, and in the middle and lower courses of Eel River and its tributaries.

37. **Hybopsis storerianus** (Kirtland). Several specimens, 5 inches in length, were caught in the pool below the lower dam at Logansport.

38. **Hybopsis kentuckiensis** (Rafinesque). *River Chub.* At all points examined on Eel River. Especially common and of large size in the lower course of this stream.

39. **Semotilus atromaculatus** (Mitchill). *Creek Chub.* Common in all the streams. The largest specimens from the upper course of Eel River.

40. **Notemigonus chrysoleucus** (Mitchill). *Golden Shiner.* From Blue Lake, Eel and Blue rivers, Blue Babe and Mud creeks. Scarce at all these points. Always found on grassy or muddy bottom in quiet waters.

41. **Dorosoma cepedianum** (Le Sueur). *Hickory Shad.* Many specimens from 2 to 10 inches in length were taken below the lower dam at Logansport. Found nowhere else.

42. **Coregonus artedi sisco** (Jordan). *Cisco.* Three specimens, each 14 inches in length, were secured in Shriner Lake at a depth of 45 feet. They are also common in Cedar Lake, but none are known to inhabit Round and Blue lakes. They spawn in shallow water from about the 25th of November to the 20th of December.

43. **Zygonectes notatus** (Rafinesque). *Top Minnow.* Not very common, but generally distributed throughout Eel River and its tributaries. A few specimens were also taken in Blue, Shriner, and Cedar lakes.

44. **Umbra limi** (Kirtland). *Mud Minnow.* This little fish was found in sluggish waters in the upper courses of Eel and Blue rivers, and in Thorn and Blue Babe creeks.

45. **Lucius vermiculatus** (Le Sueur). *Grass Pike; Little Pickerel.* Common in all waters examined except Hull Lake, where none were caught. Fishermen report it common in this lake also. Especially abundant in the larger lakes, where specimens 12 inches in length were seen.

46. **Lucius lucius** (Linnæus). *Pike; White Pike.* A number of specimens were taken at various places in Eel River; the largest of these was 2 feet in length and weighed 5 pounds. Two smaller specimens were taken in Stony Creek; their stomachs were filled with crawfish. Last summer a 7-pound pike was taken with hook and line in Eel River, near Columbia City.

47. **Anguilla chrysypa** Rafinesque. *Eel.* We did not secure a single specimen, but saw the skin of one which had been taken from Eel River, at Collamer. It was formerly very common in Blue River.

48. **Labidesthes sicculus** Cope. *Brook Silverside; Smelt.* Common in Shriner, Cedar, and Round lakes, and throughout Eel River and its tributaries. In the lakes this fish forms a large portion of the food supply of carnivorous fishes.

49. **Aphredoderus sayanus** (Gilliams). *Pirate Perch.* Inhabits quiet or sluggish waters in upper Eel and Blue rivers. A few specimens were also taken in Thorn Creek.

50. **Pomoxis sparoides** (Lacépède). *Calico Bass.* Common in all the waters of Eel River basin.

51. **Pomoxis annularis** Rafinesque. *Bachelor.* A few specimens from Eel and Blue rivers and Meredith Creek. Generally found associated with the calico bass.

52. **Ambloplites rupestris** (Rafinesque). *Rock Bass; Goggle-eye; Red-eye.* Distributed throughout all the streams. None were found in the lakes.

53. **Chænobryttus gulosus** (Cuvier & Valenciennes) *Warmouth.* Found in Eel River and in nearly all of its larger tributaries, and in all the lakes except Hull Lake. It frequents quiet waters. Nowhere common.

54. **Lepomis cyanellus** Rafinesque. *Green Sunfish.* Not common. Eel River and all its larger tributaries, and Round and Wilson lakes. It was not seen by me in the other lakes, but it no doubt inhabits them also.

55. **Lepomis pallidus** (Mitchill). *Blue-gill; Blue Sunfish.* Frequents all the waters examined. The largest from Shriner Lake measured 9½ inches in length. This is one of the most important food-fishes in the lakes.

56. **Lepomis megalotis** (Rafinesque). *Long-eared Sunfish.* Common in Eel River and in nearly all its larger tributaries. Found in none of the lakes except in Hull Lake, where one small specimen was caught.

57. **Lepomis euryorus** McKay. Only three specimens were taken, one each from Cedar and Shriner lakes and one from an old side channel in the upper course of Eel River. The largest specimen is 4½ inches long. These specimens have some points of difference from *Lepomis euryorus* McKay, but for the present they are identified with that species. The dorsal outline slightly more convex than the ventral. Head, 3; depth, 3; eye, 4; snout, 4. Mouth small, oblique, maxillary reaching to front margin of eye. Teeth on vomer. Pharyngeal teeth conical. Gill-rakers short, about 8 or 9 in number. Scales on the cheeks in 5 rows and not 6 or 7 rows as in McKay's description of *L. euryorus.* Scales on the opercle larger than those on the cheeks. Subopercle with a single row of scales. The flap of the opercle a shiny black color surrounded by a membranous margin which is whitish above and below in the alcoholic specimen. Front of dorsal somewhat behind base of pectorals and directly over insertion of ventrals. Dorsal spines all curved backwards, those in the middle the highest and equal in length to the distance from the tip of the snout to the center of the eye. Soft portion of dorsal slightly higher than spinous dorsal. Posterior insertion of soft dorsal and that of anal fin are opposite. The base of anal fin is contained twice in that of dorsal fin. The third spine of anal the longest. Ventrals inserted behind pectorals. The ventrals extend just over the vent. Pectorals not quite reaching vent. Scales ctenoid, 5-43-11. Color in spirits, above axis of body, dark olive; below, yellowish. Top of head black. The membranes of vertical fins dusky. Ventrals also dusky, with lighter margins. The pectorals are whitish. D. X, 10 or 11; A. III, 10.

58. **Lepomis heros** (Baird & Girard). Caught by me nowhere except in Round Lake, where it is not scarce. Dorsal and ventral outlines similarly curved. Head, $3\frac{1}{3}$; depth, $2\frac{1}{4}$; snout, $3\frac{1}{2}$; eye, 4 to $4\frac{1}{4}$. Opercular flap black, smaller than eye, edged with pale. Four rows of scales on cheeks. Largest dorsal spine $2\frac{1}{2}$ in length of head. Pectorals as long or longer than head, extending past front of anal. Color, dusky olive, silvery beneath, no wavy lines on cheeks, sides of body not spotted, and dorsal not mottled. Scales on lateral line about 37. D. X, 11; A. III, 10.

59. **Lepomis gibbosus** (Linnæus). *Common Sunfish.* Common in all the lakes except Hull Lake. Also common in the dam at South Whitley; scarce in the streams.

60. **Micropterus dolomieu** Lacépède. *Small-mouthed Black Bass.* Common in flowing water throughout Eel River and its larger tributaries. The largest specimen observed by me from Eel River was taken with hook and line in the dam at Pettysville. It weighed 4 pounds. None were taken in the lakes.

61. **Micropterus salmoides** (Lacépède). *Large-mouthed Black Bass.* Very common in all the lakes, where it is the most important game and food fish. It was also taken in Eel River and some of its larger tributaries.

62. **Etheostoma pellucidum** Baird. *Sand Darter.* Numerous specimens were taken in Eel River and all its tributaries from Collamer to Logansport. None were seen above Collamer.

63. **Etheostoma nigrum** (Rafinesque). *Johnny Darter.* One of the most common of darters in the streams. Also found in Cedar and Round lakes, but less common.

64. **Etheostoma blennioides** Rafinesque. *Green-sided Darter.* In all the streams, but nowhere common. None were found in the lakes.

65. **Etheostoma caprodes** (Rafinesque). *Hogfish.* From the lower course of Eel River, Paw-paw, Flowers, and Twelve-mile creeks. None were seen above Roann.

66. **Etheostoma phoxocephalum** Nelson. Many fine specimens were taken on grassy bottom in Eel River at Logansport, immediately above the wagon bridge. They were found nowhere else.

67. **Etheostoma aspro** (Cope & Jordan). *Black-sided Darter.* None were seen in the lakes, but they are common in all the streams. On some specimens from Eel River, at Logansport, the lateral spots flow together and form a solid dark band.

68. **Etheostoma evides** (Jordan & Copeland). This beautiful darter was not taken by me, but numerous specimens were secured by Prof. B. W. Evermann in Eel River, below the lower dam at Logansport. Scales 55.

69. **Etheostoma camurum** (Cope). *Blue-breasted Darter.* Scarce. In Eel River only at points between South Whitley and North Manchester. Head, 4; depth, $4\frac{1}{2}$. D. XI, 13; A. II, 8. Largest specimen taken, 2 inches long.

70. **Etheostoma flabellare** Rafinesque. Found nowhere except in Eel River between South Whitley and North Manchester.

71. **Etheostoma cœruleum** Storer. *Rainbow Darter.* Everywhere common in the streams. None were taken in the lakes.

72. **Etheostoma cœruleum spectabile** (Agassiz). Taken in Little Weasaw Creek only.

73. **Etheostoma eos** (Jordan & Copeland). Specimens were taken from each of the lakes. Most abundant in Round Lake. None from the streams. The largest specimen seen was $2\frac{1}{8}$ inches long; head, 4; depth, $4\frac{1}{2}$. D. VIII to X, 7 to 11; A. II, 7 or 8. Some of the larger specimens have two or three small black spots arranged vertically on base of caudal fin.

74. **Etheostoma microperca** Jordan & Gilbert. Numerous specimens were caught in Blue Lake, and a few in Round Lake. Found nowhere else.

75. **Perca flavescens** (Mitchill). *Ringed Perch; Yellow Perch.* Common in all the lakes. Found nowhere in the streams except in the upper courses of Eel and Blue rivers.

76. **Cottus bairdi** Girard. *Miller's Thumb; Muffle-jaw.* Common on cold, rocky bottom throughout Eel River and its larger tributaries. Also found in Weasaw Creek.

TIPPECANOE RIVER SYSTEM.

The waters of this system were examined at the following places:

1. *Loon Lake.*—This beautiful sheet of water is 9 miles northwest of Columbia City and lies partly in the counties of Whitley and Noble. It has a length northwest and southeast of $1\frac{1}{4}$ miles and a width of half a mile, and it has a maximum depth of 102 feet. The bottom is mostly sandy, its shores are low but clean, somewhat marshy at the north and south ends, and covered with water weeds. The water is very clear. It receives the waters of Old Lake and New Lake, small bodies of water lying about half a mile to the southwest of it. The outlet of Loon Lake contributes to the head waters of the Tippecanoe River. This lake was examined June 14.

2. *Big Lake* lies 2 miles to the east of Loon Lake and wholly within Noble County. It is nearly circular and somewhat larger than Loon Lake. It receives its waters from Crooked and Crane lakes, which lie immediately to the east of it. The outlet of Big Lake joins that of Loon Lake. Investigations on this lake were made June 15.

3. *Crooked Lake* is a narrow body of water having a length of about $1\frac{3}{4}$ miles; its east end is not more than one-fourth mile west of Cedar and Shriner lakes, which were described under the Eel River system. The specimens seen from this lake were in the hands of fishermen.

Loon Lake is a summer resort for fishermen. There is a hotel, a clubhouse, and a number of private cottages. The lake has a pleasure steamboat plying its waters. Big Lake has also several cottages. These lakes are well stocked with indigenous game and food fishes.

FISHES OF THE TIPPECANOE RIVER SYSTEM.

1. **Lepisosteus osseus** (Linnæus). *Common Gar-pike.* Common in all the lakes.
2. **Ameiurus nebulosus** (Le Sueur). Very abundant, especially in Loon Lake.
3. **Pimephales notatus** (Rafinesque). Loon Lake and Big Lake. Very common.
4. **Notropis cayuga** Meek. Loon Lake. Scarce.
5. **Notropis heterodon** Cope. Loon Lake. More abundant than *N. cayuga.*
6. **Coregonus artedi sisco** (Jordan). *Cisco.* Common in Crooked Lake; also found in the west end of Big Lake, but scarce.
7. **Zygonectes notatus** (Rafinesque). *Top Minnow.* Abundant in Loon and Big lakes. None from Crooked Lake.
8. **Lucius vermiculatus** (Le Sueur). *Grass Pike.* Many specimens from Loon and Big lakes. No doubt it inhabits Crooked Lake also.
9. **Labidesthes sicculus** Cope. *Brook Silverside; Smelt.* Common in Loon Lake. A single specimen from Big Lake.
10. **Pomoxis sparoides** (Lacépède). *Calico Bass.* From Crooked Lake only.
11. **Chænobryttus gulosus** (Cuvier & Valenciennes). *Warmouth.* A few specimens from Loon and Big lakes only.
12. **Lepomis pallidus** (Mitchill). *Blue-gill; Blue Sunfish.* From all the waters examined. Abundant.
13. **Lepomis megalotis** (Rafinesque). *Long-eared Sunfish.* A few small specimens from Loon Lake only.
14. **Lepomis gibbosus** (Linnæus). *Common Sunfish.* Common in Loon Lake. Not taken by me in the other lakes.
15. **Micropterus salmoides** (Lacépède). *Large-mouthed Black Bass.* Very abundant in all the lakes.
16. **Etheostoma caprodes** (Rafinesque). *Log Perch; Hogfish.* Many from Loon Lake, but none from Big or Crooked lakes.
17. **Perca flavescens** (Mitchill). *Ringed Perch; Yellow Perch.* Common in all these lakes.

LIST OF BATRACHIANS AND REPTILES OBSERVED IN EEL RIVER BASIN.

BATRACHIANS.

1. **Necturus maculatus** Rafinesque. *Mud Puppy; Water Dog.* Numerous specimens are taken in Eel and Blue rivers on the hook while fishing for suckers.
2. **Amblystoma opacum** (Gravenhorst). Not common. Found near Columbia City under logs in damp woods.
3. **Amblystoma microstoma** (Cope). *Small-mouthed Salamander.* About ponds near Columbia City.
4. **Bufo lentiginosus** Shaw. *Common Toad.*
5. **Acris gryllus crepitans** Baird. *Cricket Frog.* Common along the streams and about the lakes.
6. **Hyla versicolor** Le Conte. *Tree Frog.* At Columbia City.
7. **Rana virescens** Kalm. *Leopard Frog.* Very common along the lakes and streams.
8. **Rana clamata** Daudin. *Green Frog.* Also found along the water courses, but not so common as the former.
9. **Rana catesbiana** Shaw. *Bull Frog.* Common in sluggish waters in the lakes and streams.

REPTILES.

1. **Storeria occipitomaculata** (Storer). *Red-bellied Snake.* At Columbia City and Collamer.
2. **Eutainia faireyi** Baird & Girard. In the vicinity of Collamer.
3. **Eutainia proxima** (Say). Mr. Galbreath says it has been taken at Collamer.
4. **Eutainia sirtalis** (Linnæus). *Common Garter Snake.* Everywhere common.
5. **Tropidonotus sipedon** (Linnæus). *Water Snake.* Common along the streams. Largest taken was 35 inches long.
6. **Bascanion constrictor** (Linnæus). *Blue Racer.* A common snake.
7. **Ophibolus doliatus triangulus** (Boie). *Milk Snake; House Snake.* Seen at Columbia City.
8. **Sistrurus catenatus** (Rafinesque). *Prairie Rattlesnake.* Many were killed last summer in fields east of Columbia City.
9. **Amyda mutica** (Le Sueur). *Leather Turtle.* Several specimens from the middle course of Eel River.
10. **Aspidonectes spinifer** (Le Sueur). *Common Soft-shelled Turtle.* A few small specimens were seen in Eel River.
11. **Chelydra serpentina** (Linnæus). *Snapping Turtle.* In Eel and Blue rivers.
12. **Aromochelys odoratus** (Latreille). *Musk Turtle.* Taken in Eel River.
13. **Malaclemmys geographicus** (Le Sueur). *Map Turtle.* Several small specimens from Eel River.
14. **Chrysemys marginata** (Agassiz). *Western Painted Turtle.* Taken in all the lakes and streams. The most common turtle.
15. **Chelopus guttatus** (Schneider). *Speckled Tortoise.* Found in Eel River.

COLUMBIA CITY, *Indiana, August 14, 1893.*

7.—NOTES ON THE FRESH-WATER FISHES OF WASHINGTON COUNTY, MAINE.

By W. C. KENDALL.

The following notes are the result of a brief investigation of several lakes and fresh-water streams in Washington County, Me., conducted principally in October, 1893, with the assistance of Mr. B. L. Hardin. The collections made do not fully represent the fish fauna of the region, as the time spent in the field was very limited, the areas examined comparatively circumscribed, and the facilities for collecting necessarily imperfect. The work can therefore only be regarded as the initial step toward more thorough and extended operations in the future.

A part of this region has long been well known to sportsmen on account of the excellent opportunities it affords for both hunting and fishing, especially about the Grand Lakes. In some localities fishing is still carried on as an industry, in a small way, while in others, where this business was once conducted, it has been abandoned. Alewives are caught in Dennys River, and three salmon weirs are located in the salt-water portion of the same stream. Pickerel fishing affords employment in winter for a few fishermen on Schoodic River and Tomah Stream. In the lower lakes of the Grand Lake system a few white men and Indians make a business of fishing for white perch and pickerel. Whitefish are caught in considerable numbers in "the thoroughfare" at the upper end of western Grand Lake. The trout and landlocked salmon in Grand Lake and Grand Lake Stream afford unsurpassed angling. The salmon fishery of St. Croix River, once very important, has been almost entirely abandoned, though of late years it has shown slight improvement. The smaller fishes, though seemingly uninteresting from any other than a natural-history standpoint, are of considerable indirect economic importance. Those of the sucker and minnow families form not only a conspicuous item in the food supply of the more important fishes, but in turn they feed upon their eggs and young, thus helping to maintain the balance of nature by preventing an undue increase of either.

In this connection we may refer to the pickerel, the so-called enemy of nearly all other fishes, succumbing only to the black bass, and depending mainly upon the young of other fishes and frogs for its food, though young pickerel subsist to a great extent upon insects. If, through their own greed or by other means, their food supply is withdrawn, pickerel gradually degenerate in size and ultimately practically disappear. Many instances in support of this fact have been made known. Pickerel and black bass are certainly voracious and destructive fishes, but the writer questions whether they have not to some extent been unjustly accused. It is doubtful if trout ever

existed in large numbers in the waters of this county from which they are said to have been exterminated by pickerel; even if they did, it is probable that they had begun to diminish from other causes before pickerel were introduced to facilitate their destruction. Trout do not thrive in waters best suited to pickerel, while the latter species will not do well in the favorite habitat of the trout, and the appearance of an occasional pickerel in such places is no cause for alarm. Pickerel are lovers of quiet, muddy, weedy streams and lakes. Trout prefer cool, running water, with little of such vegetation. Whenever pickerel have existed contemporaneously with the smaller fishes, such as chubs, minnows, etc., there has seldom, according to our experience, been any scarcity of the latter. Trout, moreover, generally disappear from their former resorts far faster through human than through natural agencies. Excessive and destructive methods of fishing, pollution of the waters, and the destruction of forests are far more fatal to trout life than the natural enemies.

The writer, however, does not wish it understood that he advocates the introduction of pickerel into such waters, for they would afford an additional factor of destruction to those already in operation. Furthermore, it is well known that where pickerel or bass exist it is next to useless to endeavor to introduce and propagate the brook trout or any of its kin.

Among the fishes discussed in this paper are also included those salt-water species which occasionally or periodically enter the fresh waters for spawning or other purposes.

Local names are always more or less confusing, and they are especially so in many instances in Maine, where distinct species in neighboring localities are often known by the same name. The name "chub" is applied indiscriminately to the larger fishes of the family *Cyprinidæ;* "young chubs" or "shiners" to the intermediate sizes, and "minnies" to the young *Cyprinidæ* and to the *Cyprinodontidæ.* The catfish, *Ameiurus nebulosus*, is known generally as "hornpout," as also in some places the sticklebacks, *Pygosteus*, *Gasterosteus*, and *Apeltes.* *Catostomus teres* is commonly designated as "sucker." *Semotilus bullaris* is widely known as "chub;" but the adult *Fundulus heteroclitus*, in places along the coast, are likewise called "chub," and the young of the same species "minny." *Salvelinus fontinalis* is everywhere recognized by the names "trout," "brook trout," and "speckled trout." *Salvelinus namaycush* is known as "togue," "lake trout," or "salmon trout;" *Salmo salar sebago* as landlocked salmon and "salmon trout." The brook trout, when large, also has sometimes been misnamed "salmon trout." *Salmo salar* is commonly known as "salmon" or "sea salmon."

The local names given in connection with the scientific ones in the lists accompanying this paper are those most often applied to the fishes in the localities to which the lists relate. Where the local name was not ascertained the name used in a neighboring locality has been inserted.

BOYDEN LAKE, PENNAMAQUAN LAKE AND RIVER.

BOYDEN LAKE.

Boyden Lake is about 3 miles long; its greatest width is 2 miles. It is situated in the northern part of Perry, extending also a short distance into the town of Robinston. The water has the red color usually caused by decaying vegetable matter. The shores are for the most part rocky, but there are numerous sandy places thickly grown with rushes, the lurking-spots of the young of the various fishes that inhabit the lake. This lake is the source of Little River, which empties into Passamaquoddy Bay a few miles north of Eastport.

On August 13, a visit was made to the southern end of the lake, where several hauls of a 25-foot Baird seine were made among the rushes. The following five species were taken in abundance: *Ameiurus nebulosus* (young), *Catostomus teres* (young), *Notropis megalops* (young), *Semotilus bullaris* (young), and *Fundulus diaphanus*. The occurrence of the latter species here considerably extends its eastern range, the coast of Massachusetts having heretofore been regarded as its limit in that direction. The young of *Lucius reticulatus* (2 specimens), *Anguilla chrysypa*, *Lepomis gibbosus* (1 specimen), and *Perca flavescens* were also captured.

Pickerel of small size are said to be common in the lake, and a few black bass and landlocked smelts are stated to occur there. It is affirmed that this lake once afforded excellent trout fishing, but pickerel were introduced and subsequently black bass. However, trout have not been caught here within the memory of any one with whom we conversed.

PENNAMAQUAN LAKE.

Pennamaquan Lake, about 4 miles long and 1½ miles wide, is the source of Pennamaquan or Pembroke River, which empties into Cobscook Bay. It is situated in the southeastern part of the township of Charlotte. A small stream rising in Baring flows into it at its northern end and it receives the waters of Round Pond through a small brook. Crocker Lake is a neighboring small body of water, but has no connection with Pennamaquan Lake. Pennamaquan is connected with Boyden Lake by Boyden's meadow brook, which under certain circumstances (when higher water prevails in one or the other of the lakes) reverses its current, flowing at one time into Pennamaquan, at another into Boyden Lake. This brook is an ordinary sluggish meadow stream, full of cat-tails, water lilies, pickerel weed, bladder wort, and other fresh-water plants.

Pennamaquan Lake resembles Boyden Lake in its dark water, rocky, gravelly, and sandy shores, and luxuriant growth of rushes. We were informed that black bass were introduced into the lake about fifteen years ago, and Boyden Lake was probably supplied about the same time. Fair bass fishing is said to be found there now. A fresh breeze interfered with the success of our seining, but on August 30 the following fishes were taken in Pennamaquan Lake:

Catostomus teres. Young, few.
Notropis megalops. Few.
Semotilus bullaris. Young, few.
Notemigonus chrysoleucus. Young, few.
Osmerus mordax. Few.
Fundulus diaphanus. Common.
Lucius reticulatus. Young, few.
Lepomis gibbosus. Young, common.
Micropterus dolomieu. Young, two specimens.
Perca flavescens. Young, common.

In Boyden's meadow brook one specimen of *Lucius reticulatus* was obtained.

PENNAMAQUAN RIVER.

Near the lake, Pennamaquan River is shallow, rocky, and rapid. Farther down it is more sluggish and boggy for the remainder of its course, and abounds in the common fresh-water plants. It has three milldams: one at Pembroke village, another about a half mile above, and a third about 3 miles up. The last we did not have the opportunity of examining. Salt water makes its way nearly up to the lower dam. No artificial fishways have been constructed, but when the water is sufficiently high fish can pass through some rude excavations in the rocks at the ends of the dams.

Alewives are said, at one time, to have run up the river in abundance, but since then the numbers have greatly diminished. Many young ones, however, were seen coming down this season. Pickerel up to 3 pounds in weight are reported to be common.

A small brook enters at Pembroke, in which trout are said to be caught, as well as in the brackish water at its mouth. On October 6 several hauls of the 25-foot seine were made in the river for about 1½ miles above the second dam. The common water plants, such as cat-tails, lily pads, pickerel weed, etc., were abundant, though dead at this time. Spiders, water bugs, insect larvæ, and snails were exceedingly numerous among the grass and weeds.

The temperature of the water was 62·5° F.

The fish taken were *Notemigonus chrysoleucus*, very common; *Lucius reticulatus*, common; *Lepomis gibbosus*, common; *Perca flavescens*, common.

The abundant fresh-water plants, muddy bottoms, coves, and lagoons supplied with pickerel weed and water lilies, afford an ideal home for pickerel.

Boyden and Pennamaquan lakes also seem more suited, in their general characteristics, to such fishes as pickerel, chubs, suckers, and hornpouts, than to trout, salmon, or other species of like habits.

List of Fishes obtained in Boyden Lake and Pennamaquan Lake and River.

Ameiurus nebulosus (Le Sueur). "Hornpout."
Catostomus teres (Mitchill). "Sucker."
Notropis megalops (Rafinesque). "Red-finned Minnow."
Semotilus bullaris (Rafinesque). "Chub."
Notemigonus chrysoleucus (Mitchill). "Shiner."
Clupea æstivalis Mitchill. "Alewife." *
Osmerus mordax (Mitchill). "Smelt."
Fundulus diaphanus (Le Sueur). "Fresh-water Minnow."
Lucius reticulatus (Le Sueur). "Pickerel."
Anguilla chrysypa Rafinesque. "Eel."
Lepomis gibbosus (Linnæus). "Sunfish."
Micropterus dolomieu Lacépède. "Black Bass."
Perca flavescens (Mitchill). "Yellow Perch."

* The specimens appear to be the young of *Clupea æstivalis*, agreeing with this species in the black peritoneum. In the somewhat larger eye and slightly higher dorsal fin, they differ, however, from the usual aspect of *C. æstivalis* and approach *Clupea pseudoharengus*.

MEDDYBEMPS LAKE AND DENNYS RIVER.

MEDDYBEMPS LAKE.

On October 8, with the object of making an examination of Dennys River, we went, with a guide and canoe, to Meddybemps, where some fishing was done in Meddybemps Lake, but with little success. This lake is about 12 miles long and 5 or 6 miles wide, of irregular shape, and contains several small, wooded islands and one of fairly large size. It has an area of about 20,000 acres. For the most part, so far as we could determine, the shores and bottom are rocky, composed of large and small bowlders, with some granite ledges along the shore. At the lower end the lake was shallow, but our visit was made during the low-water season, marks on the rocks indicating that at certain times the depth becomes 4 or 5 feet greater. The water is cool and fairly clear, and in our judgment would afford an admirable place for salmon, trout, or togue, were not black bass and pickerel common in the lake, there being, however, fewer pickerel than black bass. The other fishes said to inhabit the lake are white perch (*Morone americana*), yellow perch, eels, smelts, alewives, chubs, and suckers.

At the outlet of the lake is a dam about 20 feet long. The gate, about 6 feet wide, was closed, but is open, we were told, most of the season. A fishway exists at one end of the dam, but no water was flowing through it at this time. A few rods below is a bridge, with an aperture of about 20 feet, the latter being obstructed by a closely made slat fence, having a narrow gate opening into a short sluiceway, which extends into a box about 7 feet long by 3 feet wide, provided with a wire-netting end and bottom. This contrivance was used for catching eels, which are said to pursue the young alewives in great numbers as they move down from the lake into the river. About two dozen eels were in the trap at the time of our visit. At the end of a stone dam or wall, between the bridge and the other dam, stands an old mill, under which is another fishway into the lake. Above this is a broad, shallow, muddy pool in which the seine was hauled, but without securing any fish.

Several hauls were made along the west shore of the lake, with little success, as few suitable localities for seining could be found. About 2 miles from the dam, in a shallow place, with muddy bottom, containing rushes and lily pads, two pickerel were taken, together with some mollusks (*Planorbis*) and insects.

DENNYS RIVER.

Dennys River, just below the dams and bridge, is about 25 feet wide, rocky, gravelly, and sandy, and contains many old water-logged slabs. Nine chubs, 4 to 11 inches long, were taken here. This river flows for about 20 miles from Meddybemps Lake to the village of Dennysville, through meadow land and low hills wooded with maple, low birches, etc., together with occasional tracts of spruce, fir, pine, and hardwood growths. Over a great extent the country bears evidences of the destruction of its forest by fire or other agency. For about 6 miles it is dead water, containing luxuriant growths of algæ, water grasses, weeds, water lilies, cat-tails, and many other fresh-water plants. Some places are very deep; others shallow. The bottom consists of mud and sand. Seining was nearly impossible on account of grass, weeds, and snags. Old sunken slabs were found for over a mile below the mill. About $1\frac{1}{2}$ miles below the lake a bank of sawdust, overgrown with flags and rushes, occurs on an outward curve of the river bank. Pickerel were seen here. At every place along this tract

of dead water, where it was practicable to use the seine, hauls were made. Pickerel, measuring from 6 to 16 inches long, were common. The young ones were frequently observed rising to insects and leaves which had fallen into the water. One dead chub was taken. About 4 miles below Meddybemps the river is about 30 yards wide, the temperature of the water being 55.5° F. on October 9.

At the first quick water, about 6 miles below Meddybemps, a school of young alewives was seen, but none were secured. From this place frequent rips and rapids occur in the river along the remainder of its course. They are from a few yards to a mile in length, with intervening reaches of quiet water in which water plants grow profusely. Trout are said to be common in all these rips. Frequent unsuccessful trials were made with hook and line, using minnows and worms as bait. The seine also was used in suitable places, but with no success until about 12 miles below Meddybemps. The last 6 miles were, for the most part, unsuitable, the water being deep, with abrupt banks or very swift currents. On October 10, about 6 miles above Dennysville by river, a few young pickerel were obtained from among weeds and lily pads, where the bottom was boggy, and young chubs and red-finned minnows were taken on clay bottom with short grass and shallow water. Clark Rips are located about 5½ miles above Dennysville, at the foot of a long stretch of smooth, deep water. Over these rips the water flows with considerable force, forming deep pools and eddies with gravelly bottoms behind large bowlders. In one of these eddies we succeeded with some difficulty in making a haul of the seine. Three specimens of trout were obtained, two of which were females about 10 inches long, with well-advanced but still immature ovaries; the other was about 6 inches long. The stomach of one contained a young alewife; the other caddis worms. Two young chubs were taken. The temperature of the water here was 50° F.

About a mile below Clark Rips, on Starters Rips, fine gravelly bottom, 1 young salmon, 4 inches long, and 1 red-finned minnow were obtained. At the entrance of a narrow arm of the river, which makes off a short distance below this place and rejoins the river somewhat farther down, there is a deep pool, with muddy bottom, lily pads, and boggy shore, from which numerous specimens of suckers, red-finned minnows, chubs, and a few young alewives, 2¼ to 2½ inches long, were taken. Near the lower end of Starters Rips, in a pool of a rivulet branching from the main channel through a gravel bed left dry by the low water of this season, we took many specimens of suckers, red-finned minnows, black-nosed dace, and chubs. At the foot of Starters Rips, in about 2½ feet of swift water, fine gravel bottom, 1 gravid female trout, about 13 inches long, and 1 young chub were caught, the former being liberated at once.

About 2 miles above Dennysville, in a small cove full of water plants, 5 pickerel, 4 to 12 inches long, were obtained, together with larval insects, water bugs, snails, etc. The temperature of the water was found to be 54.5° F. Just below here a jam of logs, about 200 yards long, was encountered, preventing further progress in the canoe. Below this there were short rips and another small jam of logs. The rest of the river is comparatively smooth, with occasional bowlders in shallow water, until it reaches the millpond. Below the mill the water again becomes rapid, and this character obtains down to the salt water at Dennysville. The pond is about a half mile long and from 75 to 400 yards in width. We were informed that pickerel, hornpouts, "roach" or "hogbacks" (*Lepomis gibbosus*), and eels occur there. Large eels are said at times to be abundant in the river, following the young alewives down.

The upper 6 miles of Dennys River seems to be particularly adapted to pickerel; the remainder of the river is said to be, and ought to be, a fine trout stream. The gravel bottoms afford excellent spawning-grounds for both salmon and trout. Starters Rips are reputed to be the favorite spawning-ground of salmon. Alewives find their proper spawning-ground in the lake, and perhaps in the upper part of the river. The rips and rapids are always the favorite haunts of trout in the spring and summer, and they often congregate at the mouths of spring brooks, where insects and other trout food are likely to be washed in.

Fish have access to the river from below and from the lake. Pickerel are found along the entire length of the stream; they were probably introduced into the lake as well as into the mill pond at Dennysville. How much havoc they may have wrought among the trout and smaller fishes is hard to say, but the trout are still plentiful, and in certain localities there seems to be no dearth of smaller and less important fishes. The reported decrease of pickerel in Meddybemps Lake may possibly be due to the presence of black bass.

At Dennysville Mr. Benjamin Lincoln, a prominent resident, gave us some interesting and instructive information regarding the fishes of the locality. He said that, in the early history of the town, salmon were plentiful in the river, but were smaller and of different shape than at present, having more of a "mackerel shape," and not going beyond 12 pounds in weight. In 1845 a water mill was built a mile above the present one. No fishway was placed in the dam, so that the migration of salmon, shad, and alewives up the river was interrupted, and these species were unable to reach their spawning-grounds. Shad were once abundant in the Machias, Pembroke, and Dennys rivers, but at present only an occasional one is observed in any of those streams. A single specimen was taken at Dennysville this season. Alewives as well as salmon, however, are now increasing in abundance. In 1858 the above-mentioned mill and dam were destroyed by fire, and the passage of fish again made possible. Salmon and alewives resumed their migrations to some extent, with a little increase from year to year. The lower mill, built by Mr. Lincoln's grandfather, caused no obstruction in the river, as at one end of the dam a good natural fishway was left, and it still exists, somewhat improved.

In 1874 Mr. Lincoln began the planting of young salmon in the river, a work which he continued every season until 1890, obtaining his supplies of eggs from the State or U. S. Fish Commission and hatching them at his own expense. At the latter date, however, he discontinued this commendable undertaking, the indefatigable poaching carried on by some of the residents along the stream tending to defeat his efforts. Mr. Lincoln estimates that about 250,000 young salmon have been deposited in the river. The old run of "mackerel-shaped" salmon has disappeared and larger and proportionately deeper fish ("true Penobscot salmon"), attaining as great a weight as 33 pounds, have taken their place. The quantity of fish has also greatly increased.

According to Mr. Lincoln there are two runs of salmon in Dennys River every season, one from May 15 to July 30, or thereabouts, and the other from October 1 until November. Apparently only a few males are found with the summer run. The spawning season is in November, and hooked-nosed individuals are found only at that time.

Salmon have been seen spawning a short distance up the river from Dennysville and thence all along in suitable places to above Starters Rips. It is Mr. Lincoln's opinion that the destruction of the forest by the Saxeby gale, on September 4, 1869, and subsequently by fire, has been injurious to the welfare of the salmon, as the stream is now less protected from cold and in some places it freezes to the bottom, killing eggs and young.

Alewives have again become abundant, but the "bluebacks," which were deeper, proportionately shorter, and fatter fish, and once common, are no longer found. Alewives run upstream during May and June and after a few months the young, about 2 inches long, are seen coming down in abundance. They continue to descend until late in the season, after the ice has formed. Some do not get down until spring, when they are about 5 or 6 inches long. This species spawns in the dead water.

On the morning of October 7 Mr. Lincoln opened the gate in the fishway at his milldam in Dennysville. Thousands of young alewives were seen passing down tail first until they reached the turbulent water below, where they were tossed about until they found quiet water in the eddies and pools among the rocks. Several specimens were caught in our hands and were identified as *Clupea æstivalis.*

At the time the old upper mill was in existence the proprietor, being told that pickerel were fine edible and gamy fish, introduced some into his mill pond. They multiplied greatly, practically exterminating most of the other species, leaving only "roach" and hornpouts.* Mr. Lincoln thought that the pickerel were brought from Massachusetts. They are now held in ill repute.

Cathance Lake is about 2 miles long and $1\frac{1}{4}$ miles wide, situated about 8 miles northwest of Dennysville, on the boundary line of Charlotte and Cooper townships. It is a deep, clear, cool body of water, containing an abundance of brook trout ranging in size up to as high as 4 pounds. Landlocked salmon are also common, having been introduced there some years ago. They do not attain a greater weight than 5 pounds.

The Cathance River takes its rise in this lake and joins Dennys River about $1\frac{1}{2}$ miles above Dennysville. It is a rocky stream, smaller and more turbulent than Dennys River. Brook trout are abundant, especially at its upper course.

List of Fishes obtained in Meddybemps Lake and Dennys River.

Catostomus teres (Mitchill). "Sucker."
Notropis megalops (Rafinesque). "Red-finned Minnow."
Rhinichthys atronasus (Mitchill). "Black-nosed Dace."
Semotilus bullaris (Rafinesque). "Chub."
Clupea æstivalis Mitchill. "Alewife."
Salmo salar Linnæus. "Salmon."
Salvelinus fontinalis (Mitchill). Trout, Brook Trout, Speckled Trout.
Lucius reticulatus (Le Sueur). "Pickerel."
Perca flavescens (Mitchill). "Perch," "Yellow Perch."

* Many small *Cyprinidæ* were observed by us among the logs at the lower end of the pond. The "roach" was ascertained to be *Lepomis gibbosus.*

THE WESTERN GRAND LAKE SYSTEM.

The Western Grand Lake System is the source of the West Branch of the St. Croix or Schoodic River. This system of rivers and lakes is about 50 miles long, through the Schoodic River, Leweys, Long, Big, Grand, Pocompus, and Sysladobsis lakes, with their connecting streams and thoroughfares; with a few short portages an almost continuous canoe passage can be made from Princeton, at the foot of Leweys Lake, to Passadumkeag, on the Penobscot River, a distance of over 85 miles.

Grand Lake, the largest of the chain, is about 12 miles long and in the widest place 6 miles broad. At its western end it receives, through "The Thoroughfare," the water of five or six small lakes lying to the northward, in the towns of Carroll and Kossuth, and in townships 5 and 6. Other connecting lakes are Pocompus, Sysladobsissis, Sysladobsis at the west, and Wabawsoos at the southwest. These tributary waters are said to be similar in their main characteristics to Grand Lake. Sysladobsis is the largest, being somewhat over 15 miles long, but it is narrow. It contains landlocked salmon and togue, but neither is at all abundant. Other fishes, such as suckers, chubs, pickerel, white perch, etc., are also present.

Grand Lake is deep in some places, having a depth of fully 20 fathoms, and its waters are clear and cool. The bottom and shores are composed of various-sized bowlders; there is little sand or grass, or in fact any character of bottom attractive to pickerel or other fish loving sluggish water. Landlocked salmon are plentiful, the adults ranging in weight from 1½ to 5 pounds. Togue (*Salvelinus namaycush*) reaching a weight of 30 pounds are common. Brook trout up to 2 pounds are abundant in the lakes, while the small tributary streams and brooks are well supplied with smaller individuals. A species of whitefish (*Coregonus labradoricus*), which is caught in gill nets after November 1, appears in "The Thoroughfare" at that season to spawn. This thoroughfare, situated at the head of Grand Lake, is about the only place where this fish is caught in quantities. None was obtained by us.

Grand Lake Stream is a rapid, rocky stream, with numerous gravelly pools. It is about 2½ miles long, and connects Grand Lake with Big Lake. Over most of its course the current is quite swift and two considerable rapids exist; one (called Great Falls) is about a half mile, the other (Little Falls) about 2 miles below the dam at Grand Lake. The remaining distance of half a mile has a smooth gravel bottom, which might afford spawning-beds for such fish as resort to that character of ground; but it is said few landlocked salmon are ever seen there. Just below the dam, at the foot of Grand Lake, is a deep pool with gravel bottom, and from this extend shallow rips, gradually deepening until they reach the swift current below. At the side of the rips are eddies and pools with sand and silt bottoms. Many landlocked salmon were seen spawning in the pool and beneath the bridge a short distance below. A canal, which serves as a sluiceway to the tannery, where landlocked salmon are also said to spawn, connects the lake with the stream. A few landlocked salmon were seen in the tannery end of the canal. On the rips and in the eddies young landlocked salmon, from 3 to 5 or 6 inches long, were very common.

The following fishes were taken with the seine in the above places on October 19:

Catostomus teres. Young; very common.
Notropis megalops. Abundant.
Rhinichthys atronasus. Common.
Semotilus bullaris. Young; common.

Osmerus mordax, young or very small translucent specimens, said to attain no larger size here, were common. In the lake, where they are abundant, landlocked salmon and togue feed upon them extensively. *Salmo salar sebago*, young, 3 to 5 inches long, were taken with the other fishes; one mature male, weighing 5 pounds, and one 8 inches long, were jigged below the bridge. *Fundulus diaphanus* were abundant. A few young pickerel (*Lucius reticulatus*) were taken in a small pool at the mouth of a rivulet which enters the stream near the rips; *Semotilus*, *Rhinichthys*, and young landlocked salmon were present with them. An occasional sea salmon (*Salmo salar*) has been taken in Grand Lake Stream. Mr. Rose, a resident of that place, has a drawing of one which weighed 9½ pounds, caught a few years ago.

There is a tannery, with a small sawmill adjacent, on the bank of Grand Lake Stream, just below the foot of Grand Lake. We were told that no refuse is now thrown into the stream from either of these establishments, although such was the case formerly. This statement is probably not entirely correct. Sawdust and tan bark were observed in some places along the river, and a large delta which was formed in Big Lake at the mouth of Grand Lake Stream was composed of the latter material.

On October 20, just above Little Falls, in a quiet place by the side of the rapids, where the bottom was composed of sand and sawdust, in several hauls of the seine made at short intervals, the following fishes were taken:

Catostomus teres. Two to 3 inches long; abundant.
Notropis megalops. Two inches long; common.
Rhinichthys atronasus. Common.
Semotilus bullaris. A few small specimens.
Lucius reticulatus. Small; common.
Osmerus mordax. A few small specimens like those taken in the stream above.
Fundulus diaphanus. Few.
Pygosteus pungitius. "Pinfish;" few.

Many landlocked salmon were seen in deeper water, and one young example, about 4 inches long, was caught. Some insect larvæ were taken with the fishes.

Gardiner Brook, flowing into Big Lake near the mouth of Grand Lake Stream, contains many small trout. Two were obtained about half a mile above the lake, a male 4 inches long and a female 6 inches long, both ripe and emitting spawn and milt.

Big Lake differs somewhat in character from Grand Lake, being shorter, narrower, and shallower, having a maximum depth of about 60 feet. The shores and bottom are rocky to a great extent, but the bowlders seem smaller than at Grand Lake. More weedy, muddy, and sandy places occur, especially about some of the islands which exist in both Grand and Big lakes. The water of Big Lake, as well as of the remainder of the chain below, is turbid and of a reddish hue. Hornpouts, suckers, minnows, chubs, smelts, white perch, etc., are said to abound. White perch are often seen in schools at the surface, pursuing smelts. Long and Leweys lakes are smaller and more weedy and muddy than Big Lake, but contain about the same kinds of fish.

On October 18, about half a mile above the mouth of Grand Lake Stream, in shallow water, a few young chubs (*Semotilus bullaris*) were taken. On October 20 several hauls of the seine were made on an island at the upper end of Big Lake, on a small sandy beach overgrown with rushes. One perch (*Perca flavescens*) and some gastropods and fresh-water mussels were obtained. Again, on Stone Island, at the lower end of the lake, on sandy and gravelly bottom, one young *Fundulus diaphanus* was obtained. Fresh-water mussels were abundant. The temperature of the water at this place was 51·5° F. Just below the narrows in Big Lake one young sunfish (*Lepomis gibbosus*) and a few tadpoles were taken.

Huntley Brook is 10 or 12 miles long; it rises in Waite plantation and flows south into Leweys Lake. At the mouth it is about 50 feet wide and not very deep. The bottom is covered with a deep sediment of decayed wood. The shores are boggy, with small floating islands. This spot, we were told, is a favorite fishing-place in the the proper season for white perch and chubs. Trout are said to be plentiful and of large size well up the brook, being first caught about 4 miles from the mouth. At the mouth of the stream, on October 17, young golden shiners (*Notemigonus chrysoleucus*) were seined in large numbers; chubs (*Semotilus bullaris*) of small size and sunfish (*Lepomis gibbosus*) were abundant. A few yellow perch (*Perca flavescens*) were also taken.

List of Fishes taken in the Western Grand Lake System.

Catostomus teres (Mitchill). "Sucker."
Notropis megalops (Rafinesque). "Red-finned Minnow."
Rhinichthys atronasus (Mitchill). "Black-nosed Dace."
Semotilus bullaris (Rafinesque). "Chub."
Notemigonus chrysoleucus (Mitchill). "Shiner."
Osmerus mordax (Mitchill). "Smelt."
Salmo salar sebago Girard. "Landlocked Salmon," "Salmon Trout."
Salvelinus fontinalis (Mitchill). "Trout," "Brook Trout."
Fundulus diaphanus (Le Sueur). "Fresh-water Minnow."
Lucius reticulatus (Le Sueur). "Pickerel."
Anguilla chrysypa Rafinesque. "Eel."
Pygosteus pungitius (Linnæus). "Pinfish."
Lepomis gibbosus (Linnæus). "Sunfish."
Perca flavescens (Mitchill). "Yellow Perch."

ST. CROIX RIVER.

WEST BRANCH OF ST. CROIX RIVER.

There are a sawmill and a tannery at Princeton, the refuse from the former being allowed to enter the stream. The sawdust chokes the river for 2 or 3 miles below, forming extensive banks, which in some places reach above the surface of the water. At the mouth of Georges Brook, about a mile below Princeton, the sawdust and other refuse form beds of considerable thickness. The region along the brook is boggy. Among the lily pads, in 2 or 3 feet of water, several young chubs (*Semotilus bullaris*), 3 shiners (*Notemigonus chrysoleucus*), and a pickerel (*Lucius reticulatus*) 1 foot long were taken. The temperature of the water at this place was 48·7° F. on October 21. At the foot of Black Cat Rips, half a mile below Georges Brook, on gravelly bottom with some water grass, we took 5 perch (*Perca flavescens*) and 1 pickerel (*Lucius reticulatus*). The temperature of the water was 48° F. One-half mile below Black Cap Rips the bottom was soft with a great deal of sawdust and river grass; several shiners (*Notemigonus chrysoleucus*) and red-finned minnows (*Notropis megalops*) were obtained. About a mile before reaching the mouth of Tomah Stream we obtained a young pickerel. The bottom here was composed of sawdust and refuse on which water weeds were growing. The temperature of the water was 48° F.

Tomah Stream flows southward into Schoodic River, near Squirrel Point, a few miles below Princeton. The stream is deep, with weedy margins, dark reddish water, and long bottom grass, up as far as the "Roll Dam," about 2 miles above its mouth. There is no fishway through this dam and probably no occasion for one. Trout are said to be caught at the dam, thence along the stream to its source. We seined in several places from the dam to the mouth of the stream, obtaining a few young hornpouts (*Ameiurus nebulosus*), pickerel (*Lucius reticulatus*) common, and a few perch (*Perca flavescens*).

MAIN ST. CROIX RIVER.

On October 23 we seined in St. Croix River, about 2 miles above Baring. The bottom was composed of soft clay, silt, and "eelgrass." In several hauls in different localities we took *Notropis megalops* (1 specimen), the young of *Semotilus bullaris* (numerous specimens), a few young *Lucius reticulatus*, 7 to 10 inches long, and a great many water bugs, insect larvæ, *Planorbis*, etc. Here the river was full of logs.

About half a mile below Baring, on the New Brunswick side, the river runs through meadows in which small, shallow, muddy tributary streams, or creeks are common. The river and creeks are filled with a profuse growth of the long river grass. From one of these small streams we obtained the young of *Semotilus bullaris* (common) and *Notemigonus chrysoleucus* (common), *Lepomis gibbosus* (1½ to 3 inches long, common), *Lucius reticulatus* (12 to 13 inches), and a great abundance of insects and larvæ.

Maguerrowock Stream, near Calais, runs for a long distance through bogs and meadows. It rises in the hills of Calais and flows north to St. Croix River. It its upper course trout are common. About a quarter of a mile from St. Croix River, among grass and lily pads, we took *Ameiurus nebulosus* (a few about 3 inches long); *Notemigonus chrysoleucus* (few, 3 inches long); *Lucius reticulatus* (few, young); *Lepomis gibbosus* (young, common, about 3 inches long).

List of Fishes obtained in St. Croix River and its Tributaries.

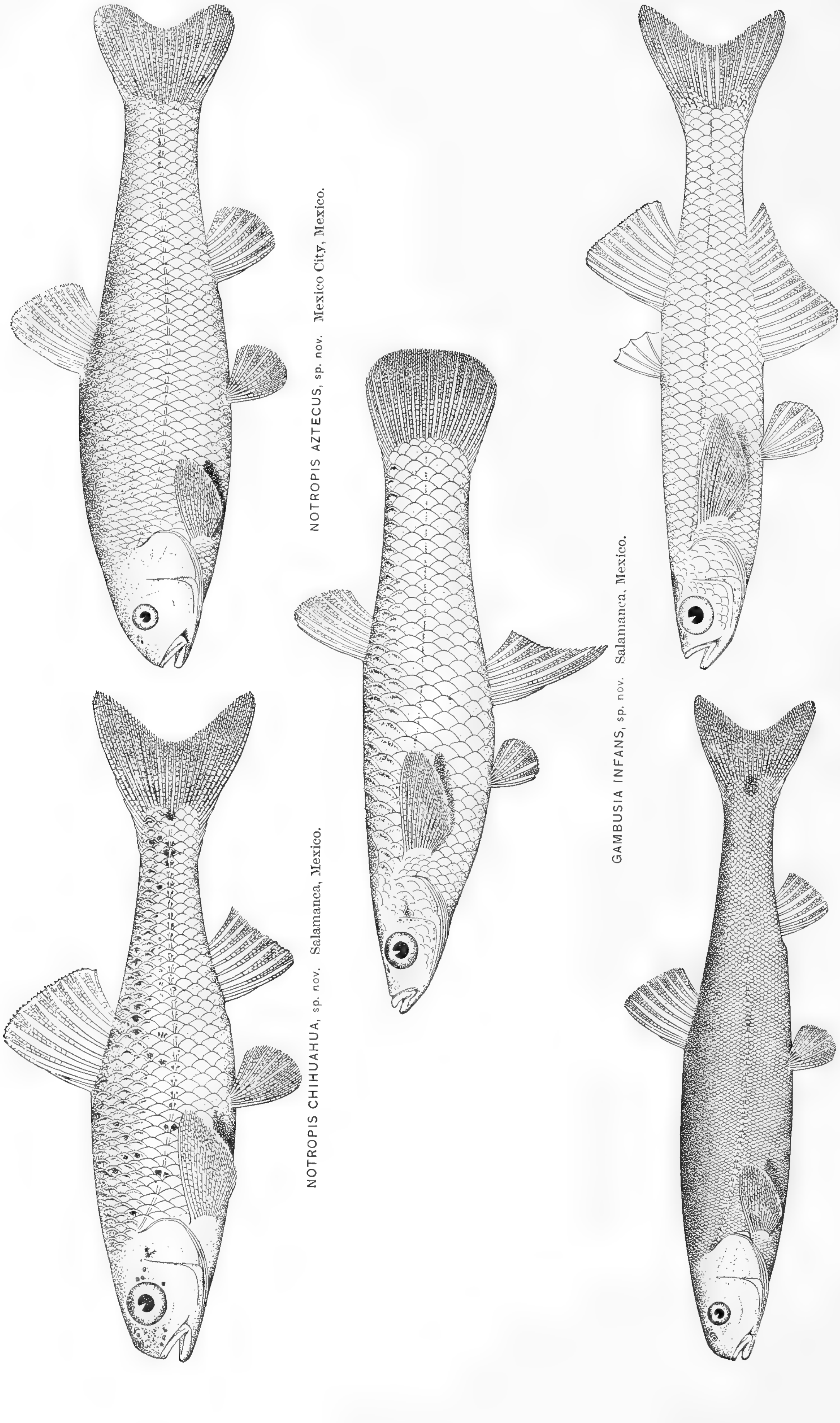
Ameiurus nebulosus (Le Sueur). "Hornpout."
Catostomus teres (Mitchill). "Sucker."
Notropis megalops (Mitchill). "Red-finned Minnow."
Semotilus bullaris (Rafinesque). "Chub."
Notemigonus chrysoleucus (Mitchill). "Shiner."
Lucius reticulatus (Le Sueur). "Pickerel."
Lepomis gibbosus (Linnæus). "Sunfish."
Perca flavescens (Mitchill). "Yellow Perch."

LIST OF THE FRESH-WATER FISHES OF WASHINGTON COUNTY, MAINE.

This list includes, besides the fishes collected by us, all other species known to inhabit the region. Further investigation would undoubtedly add to the list.

Ameiurus nebulosus (Le Sueur). "Hornpout."
Catostomus teres (Mitchill). "Sucker."
Notropis megalops (Rafinesque). "Red-finned Minnow.
Rhinichthys atronasus (Mitchill). "Black-nosed Dace."
Semotilus bullaris (Rafinesque). "Chub."
Notemigonus chrysoleucus (Mitchill). "Shiner."
Clupea pseudoharengus Wilson. "Alewife."
Clupea æstivalis Mitchill. "Alewife."
Clupea sapidissima Wilson. "Shad."
Osmerus mordax (Mitchill). "Smelt."
Coregonus labradoricus Richardson. "Whitefish."
Gasterosteus aculeatus Linnæus. "Thornback."
Lepomis gibbosus (Linnæus). "Sunfish," "Female Perch."
Micropterus dolomieu Lacépède. "Small-mouthed Black Bass," "Black Bass."
Perca flavescens (Mitchill). "Perch," "Yellow Perch."
Morone americana (Gmelin). "White Perch."
Salmo salar Linnæus. "Salmon," "Sea Salmon."
Salmo salar sebago Girard. "Landlocked Salmon," "Salmon Trout."
Salvelinus namaycush (Walbaum). "Togue," "Lake Trout," "Salmon Trout."
Salvelinus fontinalis (Mitchill). "Trout," "Brook Trout," "Speckled Trout."
Fundulus heteroclitus (Linnæus). "Salt-water Minnow."
Fundulus diaphanus (Le Sueur). "Fresh-water Minnow."
Lucius reticulatus (Le Sueur.) "Pickerel."
Anguilla chrysypa Rafinesque. "Eel."
Pygosteus pungitius (Linnæus). "Pinfish."

PLATE 2.



NOTROPIS AZTECUS, sp. nov. Mexico City, Mexico.

CHIROSTOMA JORDANI, sp. nov. Mexico City, Mexico.

GAMBUSIA INFANS, sp. nov. Salamanca, Mexico.

NOTROPIS CHIHUAHUA, sp. nov. Salamanca, Mexico.

EVARRA EIGENMANNI, gen. et sp. nov. Mexico City, Mexico.

8.—REPORT ON A COLLECTION OF FISHES FROM THE RIVERS OF CENTRAL AND NORTHERN MEXICO.

By ALBERT J. WOOLMAN.

In the summer of 1891 the writer was a member of a party which, under the direction of Dr. J. T. Scovell, of Terre Haute, Ind., traversed the northeastern and central parts of Mexico for the purpose of making certain studies of Mount Orizaba. With the assistance of Mr. Ulysses O. Cox, of Mankato, Minn., collections of fishes were made in the mountain streams at intervals between Ei Paso, Tex., and Orizaba, Mexico. A list of the species obtained and notes on the same are given in the present paper.

In mountainous regions the number of species of fishes is small, and this is especially true in Mexico, where the streams are short, their basins isolated, and the volume of water varying greatly from one season to another. The present collection contains twenty-four species of fishes, and, although small, it is of unusual interest, as six of the species obtained and one genus were new to science. As the entire collection was made in the headwaters of the streams all the forms obtained are strictly fresh-water species.

Seven families are represented in the collection. Of those taken south of the Rio Grande, nearly 50 per cent are *Cyprinidæ* and 30 per cent *Cyprinodontidæ*, while the remaining 20 per cent are divided among five other families; the *Percidæ* have two representatives in the genus *Etheostoma*, the only spiny-rayed fishes obtained; the *Catostomidæ*, *Siluridæ*, *Characinidæ*, and *Atherinidæ* are each represented by a single species.

A notable feature of the fishes of this region is the uniformity in the teeth of the *Cyprinidæ*, the dental formula in almost every case being 0, 4–4, 0. The scales of Mexican species are, as a rule, smaller than those of the related species taken farther north. Variability and richness of color are also more pronounced.

The writer is indebted to Dr. David S. Jordan, president of Leland Stanford Junior University, and Dr. Carl H. Eigenmann, professor of geology, University of Indiana, for assistance and suggestions in the preparation of this paper. Duplicate specimens of the species obtained are deposited in the U. S. National Museum, at Washington, D. C., in the museums of Leland Stanford Junior University and the Indiana University, and in the British Museum, London, England.

CLASSIFIED LIST OF THE SPECIES OBTAINED.

Order Nematognathi.
- Family Siluridæ.
  - Ictalurus punctatus. Rio Grande.
  - Ameiurus dugesi. Rio Lerma.
  - Leptops olivaris. Rio Grande.

Order Eventognathi.
- Family Catostomidæ.
  - Moxostoma congestum. Rio Grande.
  - Moxostoma austrinum. Rio Lerma.
- Family Cyprinidæ.
  - Notropis lutrensis. Rio Conchos.
  - Notropis aztecus. City of Mexico.
  - Notropis ornatus. Rio Conchos.
  - Notropis chihuahua. Rio Conchos.
  - Notropis orca. Rio Grande.
  - Leuciscus nigrescens. Rio Conchos.
  - Campostoma ornatum. Rio Lerma; Rio Conchos.
  - Couesius adustus. Rio Conchos.
  - Hybopsis altus. Rio Lerma.
  - Hybopsis æstivalis. Rio Grande.
  - Pimephales promelas confertus. Rio Conchos.
  - Algansea dugesi. Rio Lerma.

Order Eventognathi—Continued.
- Family Cyprinidæ—Continued.
  - Evarra eigenmanni. Canals, City of Mexico.
  - Hybognathus melanops. Rio Conchos.
- Family Characinidæ.
  - Tetragonopterus argentatus. Rio Conchos.

Order Haplomi.
- Family Cyprinodontidæ.
  - Gambusia nobilis. Rio Conchos.
  - Gambusia infans. Rio Lerma.
  - Pseudoxiphophorus bimaculatus. Orizaba.
  - Cyprinodon eximius. Rio Conchos.
  - Cyprinodon elegans. Rio Conchos.
  - Characodon variatus. Rio Lerma.

Order Percesoces.
- Family Atherinidæ.
  - Chirostoma jordani. City of Mexico and Rio Lerma.

Order Acanthopteri.
- Family Percidæ.
  - Etheostoma micropterus. Rio Conchos.
  - Etheostoma australe. Rio Conchos.

RIO GRANDE AT EL PASO DEL NORTE.

The Rio Grande was examined above the waterworks at El Paso. At this place there is a shallow ripple, but the bed of the stream is so rocky that a seine is handled with difficulty. Comparatively few species were taken, though the ripple was quite thoroughly seined. Following is a list of the species obtained:

1. **Ictalurus punctatus** (Rafinesque). *Channel Cat.* Very abundant; twenty or more specimens taken, averaging 10 inches in length.
2. **Leptops olivaris** (Rafinesque). *Flathead* or *Mud Cat.* Not common; only a few specimens taken.
3. **Moxostoma congestum** (Baird & Girard). Abundant.
4. **Notropis orca**, sp. nov. Teeth 2, 4–4, 2, strongly hooked. Head, 4½; depth, 5; eye, 4, small, slightly shorter than snout; D. I, 7; A. I, 8; scales, 8–12–4. Body plump, little compressed, with broad back and belly; dorsal outline somewhat elevated; head heavy, snout blunt, decurved; mouth subinferior, little oblique, lower jaw slightly included; maxillary scarcely reaching vertical of pupil; top of head unusually high and transversely rounded, so that the eye is as near to the lower as to the upper profile of the head. Interorbital space very wide and very convex, equal to the distance from tip of snout to pupil. Fins moderate; origin of dorsal a little nearer snout than base of caudal, slightly behind insertion of ventrals; dorsal high, falcate, its first rays longest, 1⅓ in length of head, its last rays less than half length of first; anal not so high, its longest rays 1½ in head and about twice as long as its last ray; margin concave; pectorals slightly falcate, almost reaching ventrals, 1½ in head; ventrals short, 2 in head, not reaching vent; caudal very deeply forked, the middle rays 2½ in longest lateral ones, which are as long as head. Scales rather large, thin; lateral line somewhat decurved. Color, in spirits, pale; sides with a broad silvery band, as broad as length of snout, bordered above by a narrow plumbeous line; back sparsely covered with fine dark punctulations, median line of back with a faint plumbeous band; top of head darkish, rest of head silvery; under parts pale; fins pale. Length, 3½ inches. Rio Grande, at El Paso, Tex.
5. **Hybopsis æstivalis** (Girard.) Typical example; the species was originally described from the Rio Grande basin.

RIO DE LOS CONCHOS AT CHIHUAHUA, MEXICO.

The river bed of the Rio de los Conchos, at Chihuahua, is more than half a mile in width, with numerous sand bars and depressions. It is, however, very little more than a bed, owing to the almost total lack of rainfall in this region throughout the year. Hence, the water in this large river bed is reduced to a very diminutive stream, which is brought from the mountains, 10 miles distant, by an aqueduct, to supply the city. About a mile below the city the stream is dammed, in order to make the water available for irrigation. Here on one side the bank is high and rocky, and the water entirely too deep for seining. The other shore is composed of a sand bank that slopes very gradually to the deeper water, and is easily accessible. The bed of the river is covered with several inches of mud; and, in the more shallow places, is thickly overgrown with waterweeds and other vegetation. The more quiet waters swarm with small fishes, which, for the most part, belong to the family *Cyprinidæ*. At the upper end of the pond, caused from damming the waters, is a clear, shallow ripple, from which a number of darters and two or three species of *Cyprinodontidæ* were taken. The following species were collected from this stream:

1. **Campostoma ornatum** Girard. This was one of the most abundant spècies in this locality. The adults differ but little in color and general shape from *Campostoma anomalum;* the sides, and especially the caudal peduncle, were marked with scattered dark spots; dark humeral bar present; orbit small and rounded. Head in length, 4; depth in length, 4+; eye in head, 5+. Four specimens of an average size measured as follows:

Length.	Head.	Depth.	Eye.	Lateral line.
mm.	*mm.*	*mm.*	*mm.*	
85	22·5	21+	4	73
80	20	20	4—	73
77	20	18	4—	72
77	20	20	4—	72

2. **Pimephales promelas confertus** (Girard). Two specimens taken; one a very large male with very bright colors, black with two broad light crossbands; pectoral fins white, except the black outer edge, which is followed by a narrow, sharply defined streak of silver. Lateral line complete.

3. **Couesius adustus** sp. nov. Body moderately elevated, compressed; the back a little elevated, the anterior profile somewhat convex; snout rather long, slightly pointed, $3\frac{1}{3}$ in head; mouth low, terminal oblique, the jaws subequal, the maxillary opposite the posterior nostril; barbel small, flattish; eye moderate, $3\frac{3}{4}$ to 4 in head; preorbital broad; interorbital space broad; scales small; those before dorsal and on belly smaller; lateral line decurved. Dorsal inserted a little behind ventrals, high and pointed; lower fins short, the pectorals not reaching ventrals, the latter to vent. Olivaceous, dusky above, sides silvery; a narrow plumbeous lateral band ending in the young in a small black caudal spot, obsolete in the adult; fins all plain. Head, $4\frac{1}{4}$; depth, $4\frac{2}{5}$; D. 8; A. 7. Scales, 13–58–8, 27 before dorsal; teeth, 2, 4–4, 2. Length, 102 mm. Three specimens were taken in the Rio de los Conchos at Chihuahua. The smallest, 65 mm. long, is more silvery and with the back somewhat arched; the barbel proportionally much longer and the black caudal spot distinct. It is probably, however, of the same species as the others.

4. **Leuciscus nigrescens** (Girard). (*Tigoma nigrescens, Tigoma pulchra,* and *Tigoma pulchella* Girard, Proc. Acad. Nat. Sci. Phila., VIII, 1856, 207; *Clinostomus pandora* and *Gila gula* Cope.)

Body elongate; head long, conical; mouth large, terminal, slightly oblique; back slightly arched, shoulders heavy; dorsal well behind ventral; anterior part of dorsal mid-

way between snout and fork of caudal; ventrals midway between snout and base of caudal; lateral line decurved, parallel with line of belly, and followed about 1 mm. above by a narrow dark lateral stripe that ends in a dark caudal spot. Teeth, 1, 4–4, 1 in one specimen examined, but this species is said to have a very variable dentition.

Length.	Head.	Depth.	Eye.	Lateral line.
mm.	*mm.*	*mm.*	*mm.*	
68	20	17	4·5	65
67	19	17	4·5	66
59	17	15	4+	65

5. Notropis ornatus (Girard). Abundant. Body very deep; head short and blunt; mouth terminal, slightly oblique; snout profusely tubercled; scales much deeper than long, very much as in *Notropis cornutus;* color smoky brown above, shading to lighter below lateral line; body with a distinct lateral stripe from the upper posterior margin of the opercle to the caudal; this is often faint or even obliterated on the anterior part of the body, but always distinct on the caudal peduncle. The body is barred with eight or ten dark vertical bars that extend from near the upper part of the body to below the lateral line. The fins are all dusky; dorsal, anal, and caudal, each with a dark bar near the outer margin; fins short; the base of the dorsal about one-half length of head; longest rays, from snout to opercle, little longer than the rays of the anal. Insertion of first rays of dorsal midway between anterior orbit and base of caudal, slightly behind ventrals, which are about midway between base of caudal and snout. The measurements of six adult specimens were:

Length.	Head.	Depth.	Lateral line.	Dorsal.	Anal.
mm.	*mm.*	*mm.*			
56	14·5	20	37	8	8
55	14·5	20 –	37	8	8
55	15·5	20—	38	9	8
58	15·0	21	38	8	8
55	14·5	20	37	8	8
59	15·0	19+	38	8	8

6. Notropis lutrensis (Baird & Girard). Color (of males especially) very bright; back light olive; sides light blue, covered with white pigment; belly white; a dark or steel blue vertical bar (width of eye) just back of the opercle; head profusely tubercled, principally in three longitudinal rows; a few of the females contained eggs. Head in body, 4; depth in body, 3+.

Length.	Head.	Depth.	Lateral line.	Dorsal rays.	Anal rays.
mm.	*mm.*	*mm*			
53	13	18	35	8	8
52	13	17	36	8	8
46	11·5	15	35	8	8

7. Notropis chihuahua Woolman. (Amer. Nat., vol. XXVI, 260, March, 1892.)

Body elongate, back but slightly elevated, rising gradually from snout to front of dorsal; head large; snout blunt, somewhat decurved; mouth medium, terminal almost horizontal; maxillary scarcely reaching front of eye; eye large, nearly 4 in head, longer than snout, but not quite equal interorbital space; anterior part of dorsal midway between snout and caudal; scales deeper than long, not crowded anteriorly; lateral line almost straight, and complete. Color light-olive or brown above; edges of scales above the lateral line sprinkled with irregularly placed, small, dark-brown dots; vertebral line present, but not conspicuous; sides of body with a plumbeous lateral stripe of about the width of the eye;

this lateral stripe can be traced through the eye and around the snout; the upper lip thickly sprinkled with minute dark dots, which, however, do not touch the lower lip; the lateral stripe terminates in an irregular spot at the base of the caudal; sides below the lateral line silvery; belly plain white. The fins are all plain except the dorsal and caudal, which are dusky, but without distinct markings; teeth, 0, 4–4, 0; grinding surfaces present, but small; ends of teeth hooked. Head in length of body nearly 4; depth, 4.

Following are measurements of a few adult specimens.

Length.	Head.	Depth.	Eye.	Lateral line.	Dorsal rays.	Anal rays.
mm.	*mm.*	*mm.*	*mm.*			
58	15	15	4	34	8	7
58	15	15	4	37	9	7
57	15—	14	4	35	8	7
53	13+	15+	3·5	34	8	7
50	12	13·5	3·5	36	8	7
49	12	13	3·5	33	9	7
54	14	14	4—	33	9	7
53	13+	14	4—	35	8	7
51	13	14	3·5	34	8	7
50	14·5	13	3·5	36	8	7

8. Hybognathus melanops (Girard). Two specimens. Body short and compressed; head small and short; nose blunt but not decurved; nape low, so that the profile does not present a regular curve; mouth small, terminal, forming a semicircle; eye large, length of snout; less than 4 in head. Dorsal about the width of one scale nearer snout than anal fin, and placed slightly in front of ventrals; base of ventrals short, equaling distance from snout to posterior edge of orbit; longest rays equaling distance from anterior orbit to posterior margin of opercle; when compressed the ends of rays reach first rays of anal. Ventrals short, reaching almost to vent. Color dark olive above, lighter below lateral line; sides covered with a very thin coat of silver, which extends to scales above lateral line; fins all pale and plain; no lateral band, vertebral stripe, or caudal spot. Teeth, 0, 4–4, 0, white, compressed. Scales, 6 or 7–42 or 43–4. Depth, $3\frac{3}{4}$ in length; head about 4 in length. This is certainly the *Dionda melanops* of Girard, and several other nominal species may be identical with it.

9. Cyprinodon eximius Girard. (Girard, Proc. Acad. Nat. Sci. Phila. 1856; U. S. and Mex. Bound. Surv., Icht., 67, 1859.)

Body short and deep; back much arched; profile presenting a regularly curved line from snout to anterior margin of dorsal; dorsal fin high, light in color, and almost plain; anal, pectoral, and ventral fins dusky; caudal spotted and with a black margin, which is preceded by a light bar of about the same width. These specimens differ from Girard's description and figure of *Cyprinodon gibbosus* (=*variatus*) in that the dark caudal bar is preceded by a light stripe, and the dorsal is very light and placed slightly behind the ventrals. Head in body, $3\frac{1}{3}$; depth, $2\frac{1}{6}$; eye in head, 4.

Total length.	Length to caudal.	Head.	Depth.	Eye.	Dorsal.	Anal.	Lateral line.
mm.	*mm.*	*mm.*	*mm.*	*mm.*			
58	48	15+	23	4	10	11	28
56	46·5	13+	20	3·5	11	11	26
61	50·5	17+	24	4	10	11	28

10. Cyprinodon elegans Girard. (*Cyprinodon variegatus* Lacépède?; *Cyprinodon gibbosus* Girard.)

Body subelliptical; head short; nose blunt; mouth small, terminal; humeral scale large; color much variegated from the dark centers in many of the scales; these sometimes arranged on caudal peduncle and sides, so as to give a faint outline of bars; opercle silvery, iridescent; anal, ventrals, and pectorals light; caudal marked with a dusky bar near its origin; dorsal fin short and low, length about equal the narrowest place in the caudal peduncle; longest rays equal distance from snout to posterior margin of the orbit; anterior

margin of dorsal slightly nearer caudal than snout; a dark spot on the last rays of the dorsal; margin of ventrals almost under origin of dorsal. Head in body, 3½; depth, 2½; eye in head, 3. Common, but not as plentiful as *Cyprinodon eximius*. These specimens probably belong to the species called *Cyprinodon elegans* by Girard.

11. **Gambusia nobilis** Baird & Girard. The general form and color is that of *Gambusia affinis*. Notwithstanding the wide range and variability of *G. affinis* there are some constant differences in specimens from this locality that possibly amount to specific importance. The depth, although somewhat hard to determine on account of the young in the abdomen, appears to be greater than that of *G. affinis;* the scales are also smaller, there being 36 to 38 against 30 to 33 in *G. affinis*. The caudal fin is never barred, and the dark bar under the eye is faint, but always present.

12. **Tetragonopterus argentatus** (Baird & Girard). Only three small specimens taken. Color steel-blue; lateral band and caudal spot very distinct. Measurements are as follows:

Length.	Head.	Depth.	Lateral line.	Dorsal.	Anal.
mm.	*mm.*	*mm.*			
50	13	17+	36	10	21
48	13—	16	36	10	21
54	14	18	36	10	21

13. **Etheostoma micropterus** Gilbert. Fifteen specimens of this fish were taken from the shallow ripples above the irrigation dam below the city. They agree, in general, with the original description (Proc. Nat. Mus., XIII, 1890, pp. 289–290), but differ in a few details, such as the smaller number of dorsal spines, coloration, etc.

14. **Etheostoma australe** Jordan. (*Etheostoma scovelli* Woolman, Amer. Nat., vol. XXVI, p. 260, March, 1892.)

Body stout; head large; snout abruptly decurved; back but little elevated; caudal peduncle broad; spinous dorsal low. Body barred with about ten bars of a dark purple color, each about 1½ mm. in width, olive between; the first, second, and fifth extending over back. Pectoral and ventral fins plain; spinous dorsal bordered with black; also an imperfect dark stripe very near base of dorsal; soft dorsal with two broken black stripes; caudal barred. Mouth horizontal, lower jaw included; maxillary extending a little past front of orbit, nearly to edge of pupil. Lateral line incomplete, reaching to about midway of soft dorsal.

RIO DE LERMA AT SALAMANCA, MEXICO.

The city of Salamanca is in the State of Guanajuato, about three-quarters of a mile south of the Mexican Central Railway and 150 miles northwest of the City of Mexico. It is built on the banks of the river Lerma, one of the largest streams in Mexico. This river is tributary to the Pacific Ocean, flowing first in a westerly direction some 80 or 90 miles to Lake Chapala, whence it continues in a northwesterly direction to the sea under the name of the Rio Grande de Santiago. At Salamanca the river is possibly 75 feet wide, with an average depth of from 3 to 8 feet. At the season of the year when the collection was made the stream was considerably swollen, very muddy, and had a swift current. The bed, especially in the more shallow places, is composed of fine gravel, with a few large angular stones. During the dry season the river is fordable in some places and the water becomes almost clear. The bed of the stream is about 500 feet in width and the banks low. The river drains a number of small lakes located on the plateau, and at Salamanca it is about 6,000 feet above sea level.

The fishes collected at Salamanca were as follows:

1. **Ameiurus dugesi** Bean. Several specimens of this fish were taken, and in abundance it came next after *Hybopsis altus*. Before seining the river the markets were visited and a number of specimens were there seen. Specimens taken by us differ in several particulars from Dr. Bean's original description. The largest specimen measured 145 mm. in length. The following comparative measurements are given, those in parenthesis being taken from the type, the others from specimens collected by the writer. Height of body contained 4 times in length ($4\frac{1}{2}$ to 5); maxillary barbel can be made to reach the origin of the pectorals and is contained 4 times (5) in the length of the body; the distance between the eyes equals 3 (4) times their greatest diameter; the length of the snout is contained $2\frac{1}{2}$ (3) times in the length of the head; the posterior nasal barbel is $\frac{1}{4}$ ($\frac{1}{3}$) the length of the maxillary barbel. The longest ray of the dorsal is contained 6 (6 to 7) times in the length of the body. The length of the base of the anal fin is contained $2\frac{1}{2}$ (3) times in the distance of the snout to the origin of the anal. D. I, 6; A., 18 to 19 (21 to 22); lateral line almost complete. The dorsal and caudal fins were tipped with black in some specimens.
2. **Moxostoma austrinum** Bean. Four small specimens obtained, the largest only 64 mm. long. Considering the size of the specimens they agree very well with the original description taken from fish, which, no doubt, came from the same stream and were collected by Prof. Dugès. (See Proc. U. S. Nat. Mus. 1879, 302.)
3. **Campostoma ornatum** Girard. Only a single specimen was taken. It agrees with others of the same species obtained at Chihuahua.
4. **Algansea dugesi** Bean. (Proc. U. S. Nat. Mus. 1892, p. 283.)

This species is related to *Algansea tincella* Girard (U. S. and Mex. Bound. Surv., 46, pl. 27, figs. 1–4), but from the very meager description and accompanying cut (drawn from a market specimen) the identity of the two can not be established. The chief difference between the specimens described by Girard and *A. dugesi* appears to consist in the size of the eye and the general form of the fish. *Algansea tincella* is deeper and less tapering from the shoulders than *Algansea dugesi*. In the right-hand column of the following table I quote the measurements of specimens given by Girard, while the left-hand column shows those furnished by the specimens collected by the author.

A. dugesi.	A. tincella.
Head in body, 4.	Head in body, 4—($3\frac{8}{9}$).
Depth in body 4.	Depth in body, $4\frac{1}{2}$.
Eye in head, 6+.	Eye in head, $4\frac{1}{2}$+
Eye in snout, $1\frac{1}{2}$.	Eye in snout, 1.
Lateral line, 69.	Lateral line, 60.
Scales above lateral line, 14.	Scales above lateral line, 12.
Scales below lateral line, 12.	Scales below lateral line, 10.
Caudal, without black spot.	Caudal, with distinct black spot.

The general outline of *Algansea dugesi* agrees more nearly with *Algansea australis* Jordan (Proc. U. S. Nat. Mus. 1879, 300). *Algansea australis* has, however, a smaller eye, which is only 6 in head, and the scales are 10–55–7 or 8.

5. **Hybopsis altus** (Jordan). *Whitefish*. (*Hudsonius altus* Jordan, Proc. U. S. Nat. Mus. 1879, 301.)

General form elongate, very regular, subfusiform, the profile presenting a gentle curve from the snout to the front of the dorsal; the belly about as much decurved as the back is arched; eye and lateral line on axis of body. The following measurements were made from a specimen 150 mm. long: Dorsal fin over ventrals, and midway between the snout and the end of the scales; length of base of dorsal 18 mm., which equals depth of caudal peduncle at its narrowest place; it also equals the distance from the end of the snout to the posterior margin of the orbit; longest ray of dorsal 30 mm., 5 in body, equal to distance from the anterior edge of orbit to posterior edge of opercle; ventral 24 mm., not reaching vent, about the same in length as anal; pectorals low, reaching within three scales of ventrals. Head small, conical, 40 mm., a little less than 4 in body, half distance (80 mm.) from snout to insertion of dorsal. Mouth medium, terminal, and slightly oblique; maxillary reaching anterior margin of orbit; barbel very short, but distinct. This barbel was overlooked by Dr. Jordan,

who therefore placed the genus in *Hudsonius*. Orbit almost circular (7 mm.), $1\frac{1}{2}$ in snout, $5\frac{1}{7}$ in head. Teeth 4, 4, hooked, one or more grooved; grinding surfaces narrow. Teeth in very large specimens more blunt. Color, olive above; sides pale; belly white; sides slightly silvered to fourth row of scales above lateral line, which is slightly decurved; cheeks and opercles silvery and without striations; fins all light and plain; 18 scales before dorsal.

The measurement of a few medium-sized specimens are as follows:

Length.	Head.	Depth.	Lateral line.	Dorsal.	Anal.
mm.	*mm.*	*mm.*			
112	28	31	42	8	8
98	25	25	48	8	8
66	25+	24	44	8	8
95	24+	24	45	8	8
96	26—	25	48	8	8
97	26—	23	48	8	8
90	24—	24	45	8	8
88	21—	22	46	8	8

This is one of the largest minnows and is about the only food-fish taken fr . this stream except *Ameiurus dugesi*. It is abundant and reaches a length of 15 inches. It is caught in nets or by hook and line, preferring worms or other dead bait. The fish is commonly known to the natives as "whitefish."

6. **Gambusia infans**, sp. nov. This little *Gambusia* bears but a slight general resemblance to other species of the genus. The color is light (due in large part, no doubt, to the muddy water), except the back, which is a light olive-green; but few scales have dark edges or other marking except a very narrow hair line along the middle of the caudal peduncle from the dorsal to end of scales; and another line of about equal length and breadth, but more distinct, which extends along the lower edge of the caudal peduncle from the last rays of the anal to the caudal fin. The total length of the largest specimen is 37 mm.; length, exclusive of caudal fin, 32 mm.; head, 7 mm.; depth, 7 mm.; first rays of dorsal midway between snout and end of caudal, or midway between the posterior margin of opercle and end of scales; insertion of anal in male almost directly beneath first rays of dorsal; base of dorsal very short, slightly more than length of orbit; diameter of orbit a little greater than length of snout, about $2\frac{7}{8}$ in head; modified anal of males about $1\frac{1}{2}$ times length of head, or about equal the distance from insertion of dorsal to end of scales. Ventral fin short, not reaching vent. D. 8, A. I–8; scales, 26.

7. **Characodon variatus** Bean. Specimens collected by the writer agree with the original description of this species by Dr. Bean (Proc. U. S. Nat. Mus. 1887, 370), except in length of head, color, and profile of body. The color is light olive-green and plain throughout, except faint traces of a lateral band on caudal peduncle; no dark spots appearing on either body or fins. The head is 4 in body, exclusive of caudal fins. In the type of *Characodon variatus* the head is given as 4 in body, including the caudal fin. The nape in specimens that I collected is depressed instead of elevated, as shown in the cut of *Characodon variatus* accompanying the original description. In this cut the dorsal is also placed nearer the caudal than it is in my specimens. Numerous other specimens collected by me agree almost perfectly with the original description of *Characodon ferrugineus* Bean (Proc. U. S. Nat. Mus. 1887, 373, plate XX). The largest of my specimens measured as follows: Length, exclusive of caudal fin, 46 mm.; head, $13\frac{1}{2}$ mm.; depth, 15 mm.; scales, 29; in type, 35. Dr. Bean has since referred this species to the synonymy of the preceding, the differences being a matter of age and sex. I am not able, however, from an examination of my specimens, to arrive at this conclusion.

8. **Chirostoma jordani**, sp. nov. Body elongate, slender, compressed; head medium, conical; mouth very oblique; upper premaxillary protractile but not produced; maxillary not reaching eye; first rays of anterior dorsal over posterior end of ventrals and slightly in advance of the insertion of the anal; first rays of second dorsal over middle of anal, the rays when depressed reaching as far toward caudal as the rays of anal; length of base of second dorsal about half that of base of anal, or equal the distance from snout to posterior edge of orbit; longest rays of second dorsal slightly exceed in length longest rays of anal or about equal the greatest depth, and about one-fourth greater than the length of the base. Pectoral fins

large, inserted above axis of body and reaching to middle of the ventrals, or about equal length of longest dorsal rays; origin of ventrals midway between snout and last rays of anal, extending beyond vent almost to anal; length equal distance from snout to posterior edge of orbit. Eye large and full, longer than snout, about 3 in head; cheeks and opercles scaled, the former with three rows of scales. Color, light olive-green, with narrow but distinct and complete lateral stripe; the three rows of scales on back thickly sprinkled with minute dark-brown dots which extend from the snout to the caudal fin. Head in length, 4; depth, 5. Measurements of five adult specimens were as follows:

Length.	Head.	Depth.	Eye.	Lateral line.	Dorsal.	Anal.
mm.	*mm.*	*mm.*	*mm.*			
53	12·5	11	3+	36	IV, 10	I, 16
49	12—	10	3	36	IV, 10	I, 16
46	11	9	3—	37	IV, 10	I, 16
46·5	11+	9+	3	37	IV, 9	I, 16
46·5	11+	9+	3	35	IV, 9	I, 16

Numerous specimens also taken from the canals at Salamanca and in the City of Mexico. In the City of Mexico this species, with a small cyprinodont (which unfortunately I did not secure alive), was sold in the market, imbedded in meal and baked in corn husks. This species differs from *C. brasiliensis* in having the first dorsal placed farther forward and with fewer rays in the anal. Specimens from Salamanca have 17 rays in the anal. This is evidently the same species sent with a number of other fishes to the National Museum at Washington by Prof. A. Dugès, from Lake Chapala and the stream of Guanajuato, Mexico, and listed by Dr. Jordan as doubtfully *Chirostoma brasiliensis*, in Proc. Nat. Mus. 1879, 299.

CITY OF MEXICO.

But little fishing was done at the City of Mexico. From recent heavy rains the lakes had been filled with water and all the low land flooded; most of the canals connecting the larger lakes were bank-full of water. Over these and the neighboring ponds and bayous quantities of algæ, lemna, and other water vegetation grew in great luxuriance, so that drawing a seine for specimens was laborious and uncertain work. The markets were visited, but few fresh fish excepting those brought from the coast were seen, and we were informed that very little fishing was carried on by the local fishermen at this season of the year, although during the dry season many fish are taken from the lakes and canals. Three species only were obtained in these waters, and one other was seen in the market, a specimen of which, in suitable condition for identification, could not be secured.

1. **Notropis aztecus**, sp. nov. This fish was obtained in great numbers from the canal in the City of Mexico. The specimens from which the following measurements were taken were of an average size, about 77 mm. long.

Body short and compressed; contour gently arched from snout to dorsal, decurved below; lateral line almost straight, lying along axis of body. Head short and blunt, 18 mm.; snout blunt but not decurved; mouth terminal slightly oblique; maxillary reaching line of orbit. Eye very small, 3 mm., about 6 in head; orbit circular; dorsal behind ventral, somewhat nearer end of scales than snout; base very short, 8 mm., about depth of caudal peduncle in narrowest place; fin low, 10 mm. in height, a little less than longest caudal ray or distance from posterior margin of orbit to end of opercle; insertion of anal two scales nearer caudal than end of dorsal ray when compressed; base short, 5 mm., equally distant from snout to orbit; longest rays 8 mm., same as base of dorsal; ventrals midway between snout and base of caudal, short, not reaching vent; longest rays 8 mm., equal half the distance from the origin to the first rays of anal. Upper part of body of a slaty or iron gray; some of the scales with a metallic blue luster, somewhat lighter below lateral line; belly

light or pale yellow; sides covered with a thin coat of silvery pigment; a wide dark lateral stripe visible in some specimens, in others overshadowed by the general darker color; no darker caudal spot; opercles and cheeks silver. Lateral line nearly straight; scales, 8-54-7. Head, in length, 4; depth, $3\frac{3}{5}$. Lateral line somewhat broken and interrupted on caudal peduncle. Measurements from six adult specimens are as follows:

Length.	Head.	Depth.	Lateral line.	Dorsal.	Anal.
mm.	*mm.*	*mm.*			
78	20	23	53	8	8
81	20	23+	54	8	8
77	18·5	20+	53	8	8
73	18	20—	55	8	8
72	17+	20	54	8	8
73	18	20	54	8	8

2. **Evarra eigenmanni**, gen. and sp. nov. Body elongate, somewhat fusiform; back little elevated, giving an even curve to the profile from above eye to dorsal; belly slightly curved. Head small and long; snout thick and blunt, decurved; mouth small, terminal, horizontal; edge of lower lip somewhat hardened; lower jaw included; the upper jaw slightly projecting; maxillary falling a little short of orbit; no barbel; eye small, 5 in head, $1\frac{1}{2}$ in snout, and 2 in interorbital space. Body plump; the greatest thickness just behind the extremity of pectorals is 10 mm., which equals $\frac{2}{3}$ the greatest depth. First rays of the dorsal placed behind ventrals, midway between snout and fork of caudal; base of dorsal short, 7 mm., equaling distance from snout to middle of pupil, or a little more than depth of caudal peduncle at its narrowest place; longest dorsal ray, 10 mm., equals depth of head; depth of the body at last dorsal ray equals distance of snout to opercle, or thickness of body. Anal placed far back, 18 mm., from end of caudal peduncle, a little more than half the distance from dorsal to end of scales (34 mm.); base of anal, 5 mm., equaling distance from snout to anterior edge of orbit, its longest rays 8+mm., equaling length of base of dorsal, or distance from snout to posterior part of orbit. Ventrals short, 7 mm., equal in length $\frac{1}{2}$ distance from origin of anal to anal opening. Pectorals inserted midway between lateral line and lower line of body; length, 10 mm, about the same as the longest dorsal rays.

Color, in spirits, smoky brown above; a narrow stripe somewhat lighter on either side of back, followed by a narrow and darker lateral band; vertebral stripe very dark; much lighter below the lateral line; belly light, tinged with yellow; scales silvered from belly to lighter shade on back. Fins almost plain; dorsal and caudal dusky; the latter with a dark spot at base; pectorals, ventrals, and anal, pale; opercles silvery; snout dusky; lateral line straight and complete, with 88 scales, 17 rows above and 14 below; head in length of body, 4; depth, 5. Three specimens measured as follows:

Length.	Head.	Depth.	Lateral line.	Dorsal.	Anal.
mm.	*mm.*	*mm.*			
71	17	14	88	8	I, 7
64	14·5	13	86	8	I, 7
55	13	11	88	8	I, 7

Teeth 0, 4-4, 0. The intestine is but a little more than the total length of the body.

This species seems to be the type of a distinct genus allied to *Tiaroga*, *Phenacobius*, and *Agosia*, for which I suggest the name *Evarra*. *Evarra* is distinguished from *Tiaroga* by its protractile premaxillary; from *Phenacobius* by the form of the mouth and lips, which, with its small scales, also distinguish it from *Notropis*. *Agosia* differs in the presence of a barbel.

3. **Chirostoma jordani** Woolman.

RIO BLANCO AT ORIZABA.

Orizaba is a city in the central part of the State of Vera Cruz, on the Mexico and Vera Cruz Railway, about 175 miles southeast of the City of Mexico and 65 miles northwest of Vera Cruz. It has possibly 10,000 inhabitants, and is situated about 4,000 feet above sea level, in the foothills of Mount Orizaba, or Citlaltepetl, the highest mountain in Mexico. It is located on a branch of the Rio Blanco, which flows nearly due east to the Gulf of Mexico. This branch of the river rises a short distance north of the town of Orizaba, in large deep springs, which, during the wet season, spread over several acres of ground. The stream flows a distance of about 120 kilometers before reaching the gulf, and in this distance falls more than 4,000 feet. It passes for the most part over a series of rapids at an average rate of possibly 6 miles an hour, in many places making perpendicular descents, and in one instance falling more than 100 feet in a single leap. That the fishes found in this locality have inhabited these waters for a very long time is evident, since it would be impossible for them to ascend from the lower lands. Only a single species was taken at this place, and it was very abundant. It was taken from the mill race about the water wheels, and in the bath house. Wherever a nook of quiet water occurred this little fish could be seen in great numbers, swimming near the surface of the water. A Spanish boy who assisted in capturing the specimens insisted that much larger ones were sometimes found, and were frequently taken during times of low water; and it is due to his ingenuity that the largest and finest specimens that I brought away were obtained.

1. **Pseudoxiphophorus bimaculatus** (Hæckel). (*Xiphophorus bimaculatus* Hæckel, Sitzgsber. Akad. Wiss. Wien, 1848, p. 196.)

The genus *Pseudoxiphophorus* differs from *Gambusia* chiefly in the long dorsal, and this characteristic is of doubtful value since the number of rays range from 12 to 15, those of *Gambusia* ranging from 7 to 10. Hæckel describes two species of *Pseudoxiphophorus* from the Orizaba region. These he distinguishes by the form of the anal process, hooked in *bimaculatus* and straight in *reticulatus*. *Bimaculatus* has dorsal 14, anal 10. *Reticulatus* has dorsal 16 and anal 10. I find both forms in my collection, but doubt the value of the distinctions, as it is not unlikely that they represent simply extremes of variations. *P. bimaculatus* (the variety with the longer anal) is by far the more abundant. The form of the anal process seems to be of slight importance. The length, however, is quite variable, but whether or not the end is curved seems rather to depend upon the length. The longer the organ the more liable it is to be curved. In most of my specimens, however, the organ is nearly straight.

The general color in *P. bimaculatus* is uniform olive-brown with the posterior part of each scale marked with a crescent-shaped spot; a large steel blue spot on the opercle just behind the eye; cheeks, lower part of the opercle, and breast from the pectorals down, and anterior part of the belly, orange; humeral scale black, but not enlarged; a large dark ocellus, about the size of the eye, on the upper posterior margin of the caudal peduncle. Dorsal fin with a row of dark spots on membrane, at about midway of rays; also a second row of spots near base of fin. The anal fin is marked similarly, except the anterior part is plain, giving it the appearance of a dark spot on anal; pectoral, ventral, and caudal fins almost plain. Body moderately elongated, slightly but regularly arched above; head very broad and low, so that the upper margin of the orbit is nearly on a level with top of head between the eyes; belly much decurved; line of curvature quite regular from the upper margin of the lower lip to origin of ventrals; upper margin of lower lip, when mouth is closed, on a level with top of pupil; also on a level with the second row of scales from dorsal. Eye medium, orbit circular, the diameter of which is about the length of snout, $3\frac{1}{2}$ in head, or $2\frac{1}{4}$ in interorbital area. Scales large, deeper than long; 12 rows with from 29 to 31 scales in length of body; 13 or 14 before dorsal.

Head in adult specimens about $4\frac{1}{4}$ in body, not including caudal; in depth, $3\frac{1}{4}$; base of dorsal half as long as the distance to the insertion of the fin and one-fourth the length of the body; the first rays of dorsal about midway between base of caudal and line between cheek and opercle, or half way between snout and extremity of caudal; the dorsal is low, the rays about as long as the interorbital space. Pectoral fins are broad and short, inserted about the axis of the body and reaching origin of the dorsal and almost to anal, which is nearly under the first rays of the dorsal. Anal fin short; the first two rays undeveloped, the fourth being the longest; this equals distance from snout to opercle; when the fin is depressed the rays reach as far as the origin of the last rays of the dorsal. The measurements of six large specimens are as follows:

Total length.	Length to caudal.	Head.	Depth.	Eye.	Dorsal.	Anal.	Lateral line.
mm.	*mm.*	*mm.*	*mm.*	*mm.*			
88	77	19	*23	5	13	†8	29
82	71	18	19	4·5	11	8	30
79	69	17	*24	4+	11	8	31
79	69	17	19	4+	13	8	31
75	65	15	18	4−	12	8	31
64	73	16	18	3+	12	8	31

*Abdomen distended with young. † The two undeveloped rays were not included.

In some specimens corresponding to *P. reticulatus* there are 14 or 15 dorsal rays; the color of the male specimens is practically the same as that of the females, excepting that the spot on the anal is lacking; size much smaller, the largest male taken having a total length of only $46\frac{1}{2}$ mm. The pectorals reach to the middle of the ventrals and the ventrals beyond the anal opening; the insertion of the anal is much further forward than in the females and is nearer the snout than the dorsal, the long modified rays reaching as far toward the caudal as do the longest dorsal rays when depressed.

Several specimens seem to correspond with *P. reticulatus.* These may be described in the following manner: Snout broad, spatulate, the lower jaw projecting. Eye equal to snout, $3\frac{1}{2}$ in head, 2 in interorbital space. Anal process in male $1\frac{1}{2}$ in head, ordinarily with a slight curve at the tip. Caudal peduncle short. Anal fin inserted in front of dorsal. Dorsal long, its length 3 in body. Coloration as in *Pseudoxiphophorus bimaculatus*, but darker and more profusely dotted with brown. A larger black spot on upper half of root of caudal and a trace of another behind gill-opening. Occiput and snout dark brown. Scales on back and sides with a dark-brown crescent. These do not appear on scales of lower parts, as in *P. bimaculatus.* Dorsal fin with dark-brown cross streaks made of dark spots. Fins, scales, cheeks, and opercles profusely dotted with brown. Head, $3\frac{1}{2}$; depth, 4; D. 15; A. 8. Scales, 31–8. Length, $2\frac{1}{2}$ inches. It is my opinion that these specimens represent individual variation only and that but one species of the genus *Pseudoxiphophorus* is known. The validity of *Pseudoxiphophorus* in distinction from *Gambusia* is also brought in question, since the length of the dorsal is made the principal basis of generic distinction, and this is quite variable in the specimens collected.

9.—REPORT OF INVESTIGATIONS RESPECTING THE FISHES OF ARKANSAS, CONDUCTED DURING 1891, 1892, AND 1893, WITH A SYNOPSIS OF PREVIOUS EXPLORATIONS IN THE SAME STATE.

By SETH EUGENE MEEK,

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INTRODUCTION.

During the summer of 1891, the writer, accompanied by Prof. P. H. Rolf, of the Florida Agricultural College, spent five weeks in exploring certain parts of Arkansas, with the combined objects of obtaining information respecting the character of the different streams and the abundance and variety of their fishes, for the purposes of the U. S. Fish Commission, and of securing data to be used in the preparation of a report upon the fishes of Arkansas, for the State Geological Survey. The latter report was written a year ago, but the completion of the present paper has been delayed in order to include the results of later investigations made in 1892, the writer, in the meantime, having become a resident of the State, and having thus secured opportunities to work upon this subject to much better advantage.

In the spring of 1892, with the coöperation of Prof. J. McNeill and two students of the Arkansas Industrial University, visits were paid to several streams lying east of Fayetteville, namely: War Eagle River near Huntsville; King River at Marble; Big Buffalo River near Loafer's Glory; Little Buffalo River near Jasper; Walnut Fork of the Piney River at Swain; Mulberry River west of the Loafer's Glory; White River near Thompson.

The high water during this period of the year prevented our obtaining as much material as we would otherwise have expected, and War Eagle and Mulberry rivers were so much swollen as to make any collecting in them impossible. These investigations, however, were not without some good results, and subsequently they were extended to the streams in the neighborhood of Fayetteville.

The body of this report deals only with the explorations conducted during 1891, 1892, and 1893, but it closes with a synopsis of the published results of all former ichthyological work carried on within the borders of this State. Very much remains yet to be done in this direction, however, before we can expect to obtain even a fair knowledge of the fishes of the State and of the relations of the different river basins. The lowlands have hitherto been almost entirely neglected and scarcely enough has been ascertained regarding that region to indicate, even in a superficial way, the character of its fish fauna.

The uplands comprise the northwestern two-fifths of the State and belong to the Ozark Mountain region. The highest point of this area is a little less than 3,000 feet above sea level, while its average elevation is between one-third and one-half that amount. The surface is much broken, the rocks belonging chiefly to the Upper and Lower Carboniferous systems, a small portion to the Silurian. The remainder of the surface of Arkansas is either low and rolling or consists of low, flat alluvial lands, the former being mainly of Tertiary or Cretaceous origin, the latter Quaternary. The general dip of the rocks north of the Arkansas River is south. The outcrop in the northern portion of the State, as far east as Batesville, consists of a cherty limestone, with occasional pockets of light-colored sandstone which crumbles readily when exposed to the air. This formation also covers a large part of southern Missouri, and in it are formed nearly all of the prominent caves for which the contiguous parts of these two States are noted. In disintegrating, this limestone leaves many small angular pieces of flint lying on the surface or embedded in the soil. Much of the rainfall is quickly absorbed by the porous material thus formed, only to reappear again in the many large and beautiful springs so characteristic of this entire region. Mammoth Spring, in northern Arkansas, is the largest spring in the Mississippi Valley. Roaring River is a large spring, about 8 miles east of Seligman, Mo., and at present with 16 feet of head, about one-half of the water supplied is sufficient to drive two turbine wheels of 16 and 24 horse-power, respectively. A spring nearly as large as the last occurs about 5 miles east of Lowell, Ark., and there are other large springs near Springdale and Rogers. Johnson Spring, 5 miles north of Fayetteville, discharges about 2,500,000 gallons of water every 24 hours, and many others similar to the above will be found in different places.

A few of these springs are now utilized for fish-cultural purposes entirely by private individuals, except at Neosho, the site of the U. S. Fish Commission hatchery, which has yielded results far exceeding expectations. The Mammoth Spring hatchery has been very successful. The trout placed in the spring ponds near the waterworks at Rogers by the Government have done very well. Mr. Stultz, who has been raising carp near Springdale during the past four years, has found the business profitable, and proposes soon to stock some of his ponds with rainbow trout. As his facilities for this purpose are very superior, we are confident of his success. One of the springs near Johnson has been successfully used for rearing carp to a slight extent, but much larger ponds have been constructed there during the past year, and they will soon be stocked. Mr. Davidson and Mr. Williams, of Fayetteville, are also utilizing ponds supplied by springs for fish-culture on a small scale. There seems to be no reason why this branch of industry should not be greatly extended, and many small areas not suited for other purposes could be utilized in this way.

The drainage of Arkansas is entirely toward the Mississippi River, and may be subdivided into six smaller basins, namely, the St. Francis, White, Arkansas, Bayou, Ouachita, and Red River.

The St. Francis River has its origin in southeastern Missouri and drains only a small part of northeastern Arkansas, which, with the exception of Crowley's Ridge, is very swampy. It is a broad, deep, and slow-flowing stream, having no very important affluents in Arkansas. Its basin has never been visited by ichthyologists, but the fact that it comprises the sunken lands would make its study very interesting.

The White River rises in the northwestern part of Arkansas, flows northeasterly for a short distance through Missouri, and thence southeasterly, emptying into the Arkansas River near its mouth. Its basin is the largest in Arkansas, and comprises the greater part of the State north of the Arkansas River, including most of the Ozark Mountain region north of that river, which is, in some places, very rugged. The upper portion of this basin is chiefly covered with the cherty limestone already mentioned, in which are many caves and from which flow many large and beautiful springs. The upper two-thirds are covered with a heavy growth of timber, such as oak, pine, and cedar, which becomes still heavier in the lowlands, the most abundant varieties there being oak, yellow pine, poplar, ash, etc. The main river is navigable for small steamboats as far as Buffalo City, a distance of 200 miles from its mouth, except during periods of very dry weather. It has a moderately rapid current, and a rocky or sandy bottom; but from Newport toward the mouth the bottom consists of sand and mud, and the current becomes more sluggish. It is one of the clearest and most beautiful streams in the Mississippi Valley.

The more important tributaries of the White River are the War Eagle, Kings, Buffalo, and Little Red rivers, on the south, and the North Fork and Black rivers, on the north, within the boundaries of the State. At least half of the investigation with respect to the fishes of Arkansas has been done in this basin.

The Arkansas is the largest river in the State. Its waters resemble those of the Platte and Missouri, holding in suspension much sand and silt, which give it a muddy appearance, while the fishes taken from it have the pale, sickly look, characteristic of the fishes of those rivers. The few tributaries it receives from the salt region of southern Kansas make its waters slightly saline. The basin of the Arkansas extends entirely across the State in a general northwest and southeast direction; at the west it is half as wide as the State, but it narrows eastward until its width is reduced to scarcely more than 10 miles. It lies mostly in a sandstone district. The important tributaries within the State are all mountain streams, resembling those of the upper White and Ouachita rivers.

The Bayou Bartholomew drains a small portion of the State south of the mouth of the Arkansas River, the area included within its basin being low rolling or flat. No collections have ever been made in this region.

The Ouachita River, with its tributaries, drains most of the mountain region south of the Arkansas River, and thence flows through the rolling and low lands of the southeastern part of the State, passing into Louisiana. It resembles the White River, but drains less of the upland and more of the lowland. The fish fauna of this river and of the White is very similar to that of the upper Tennessee River. Some collections have been made in the upper tributaries of the Ouachita and in the river itself.

The Red River drains only a small part of southwestern Arkansas, a low, gently rolling region. It bears a close resemblance to the Arkansas River, its waters being nearly always turbid from the fine silt brought down from the upper part of its basin. The only collection of fishes from this basin was obtained at Fulton, in 1884, by Dr. David S. Jordan and Prof. Charles H. Gilbert.

The extent of the territory drained by each of these river systems is as follows: White River, 17,470 square miles; Arkansas River, 12,300 square miles; Ouachita

River, 11,200 square miles; Red River, 3,780 square miles; Bayou Bartholomew, 2,650 square miles.

From an ichthyological standpoint Arkansas is well favored. The State is bordered on the east by the Mississippi, and has four large navigable rivers flowing through it. Two of these rivers, with most of their tributaries, rise in the Ozark Mountains within the boundaries of the State. These streams are fed by many large and beautiful springs, whose waters are cool enough for the mountain trout, their suitability being well demonstrated by the success which has attended trout-culture at the several hatcheries already mentioned. In fact, it has been proven, not only that trout will thrive in the Ozark Mountain region, but that their growth there is much more rapid than in some other places farther north, where their artificial cultivation is being carried on. The important question for the consideration of the practical fish-culturist is, how many pounds of fish he can secure from a certain number of eggs within a given period and with the least expenditure for artificial food. The records of the Neosho hatchery clearly indicate that fish-culture can be conducted successfully in this direction. While the mountain streams bid fair to contain an abundance of trout in the near future, the larger and more sluggish waters are well suited to the coarser food-fishes native to the State, the most important among them being the black bass, wall-eyed pike, eastern pickerel (*Lucius reticulatus*), buffalo-fishes, etc.

All of the important rivers mentioned supply many fishes to the markets every year, and they may continue to do so if assistance shall be given toward restoring, so far as possible, the balance of life in favor of those species which man has done so much to destroy.

These streams drain large areas of woodland and a region in which there is a considerable amount of rainfall, well distributed throughout the year. In the rocky and lower mountainous regions, intermediate between the mountain and lowland levels, the streams have cut deep and wide beds, in many places forming small lakes and affording habitation for the larger fishes during the drier portion of the year.

There is no doubt that Arkansas possesses piscatorial features of a high grade, which warrant more attention in the future than they have received in the past. The angler may find amusement along the picturesque streams of the Ozark Mountains, while the fish-culturist will come to recognize in this region one of his richest fields in North America.

Arkansas is as yet only thinly settled, and a thorough exploration of the streams of the State before their faunæ have been much changed by cultivation would be of great economic and scientific interest. The increase and protection of her food-fishes, both the native and introduced species, can not be successfully accomplished without a more complete knowledge of the physical and natural-history features of the streams, and it is to be hoped that the means for making such a survey will not long be delayed.

TROUT-REARING AT NEOSHO, MISSOURI.

The following notes on some of the methods and results of rearing trout at the U. S. Fish Commission station, at Neosho, Mo., kindly furnished me by Mr. W. F. Page, the superintendent of that station, will be read with interest in this connection:

On the files of the Neosho station are quite a number of letters detailing catches of rainbow trout, 3 to 7 pounds in weight, in the Ozark waters in 1893. The majority of the fish caught were from plants of yearling fish made from the Neosho station in 1891, though some were the results of fry planted by the Missouri Fish Commission in 1880; notably, those caught in Lawrence and Pulaski counties, Missouri. That these fish may have an opportunity to get a start and a firm hold on these waters, and to commence natural reproduction, it is not deemed politic at this time to make public the names of the streams and the localities where they are known to be acclimated. In general, it can be accepted that wherever in the Ozark system healthy trout have been planted, with due regard to the conditions of local environment, all reasonable expectations have been realized. This is to be accounted for partly by the fact that the streams are in the main fed by bold, generous, warm springs (ranging in temperature from 57° to 59° F.) preserving a nearly equable temperature; and by the further fact that in nearly all these streams there exists a multitude of organisms suited to the diet of the *Salmonidæ*. My limited observations lead me to believe that this latter important factor is more pronounced in those waters having their rise on the southern and eastern slope of the Ozark uplift. Several of the smaller streams could be mentioned which have, to all appearances, the same conditions, except that they are of higher temperature (but fortunately they are *not too high*), as the celebrated trout streams of Caledonia, N. Y., and Castalia, Ohio.

The cultivation of trout at the Neosho station on the one side, and at the Mammoth Spring hatchery on the other side of the uplift, met with unprecedented success. On the inauguration of the effort it was doubted by many if trout could be grown so far south of their natural habitat. The experience of these two establishments has not only demonstrated that they can be grown in this latitude, at the low elevation of 1,000 feet and less, but grown to a size in a given time not surpassed by any hatchery in the world, and further, that not only are their generative organs not stunted by this forcing process, but that they develop in from one to two years sooner than in other localities. Yearling trout which were shipped in 1891 from Neosho to Castalia, Ohio, were there pronounced from size and appearance to be past 2 years old. Nearly half a million trout eggs shipped from Neosho in the winter of 1892–93, to States ranging from Nebraska to Vermont, were pronounced in every case to have produced first-class vigorous fish. These eggs were the *surplus* yield from 3-year-old trout raised at Neosho. The same stock at 2 years old had given us a handsome lot of eggs.

A study of the accompanying tables will show that in this country trout can be made to attain the best marketable weight, namely one-fourth to one-third of a pound, by the end of their fourteenth month, at a cost of less than 7 cents a pound. From the study at present being given to the subject of the food of fishes under domestication, it is not improbable that in the near future this cost may be reduced 50 per cent. As it is, trout at 7 cents a pound gives a handsome revenue on the wholesale market price of 40 cents.

The fish-culturist engaged in rearing the finer grades of fish for the market can find no better water and climate for his work than is furnished by the uncounted springs of the Ozarks. It is here, in the shortest time, with the least expenditure of food materials, that he can convert his eggs into pounds of trout.

FEEDING AND GROWTH OF RAINBOW TROUT IN THEIR SECOND YEAR.

On February 20, 1893, we counted 1,500 13-months-old extra-select rainbow trout into pond No. 2, to be raised for future brood stock. Their total weight was 140·5 pounds, an average of 93·67 pounds per 1,000; their average length was 7 inches each.

April 26, 1893 (65 days afterward), these trout were reweighed and found to average 260 pounds per 1,000, and to measure from 8 to 9 inches, being an increase in weight of 178 per cent. During these 65 days they had been given 185 pounds of liver and 1,008 pounds of mush, costing $9.29; or each pound of trout gained (after the 20th of February) cost a fraction over 3⅝ cents.

May 20, 1893, 90 days after the fish were first put into No. 2 pond, they were again reweighed and found to average 320 pounds to the 1,000 fish and to run from 9 to 9½ inches long, being an increase in

weight of about 241 per cent. During these 90 days they had been given 305 pounds of liver and 1,627 pounds of mush, costing $17.01; or each pound of trout gained (after the 20th of February) cost a fraction over 5 cents.

Prior to April 1, 1893, liver cost 3½ cents a pound; after that the price was 4½ cents a pound. The cost of mush remained unchanged, namely, ¼ cent a pound.

Up to the time these fish were transferred to pond No. 2 they had been all the time in a pool 8 feet by 22 feet, among a lot of 6,000 other yearlings. The element of range so essential to the growth of fish was entirely lacking, as was also that of space and natural pasturage. Pond No. 2, into which they were transferred, supplied to a certain extent these requisites. It has a water surface of about 12,000 square feet and a greatest depth of 36 inches, whereas the pools had a greatest depth of only 2 feet, wooden sides and bottom, and with a constant change of 55 gallons of water per minute, the maintenance of pasture under these conditions being impossible. Pond No. 2 is, for at least a quarter of its area, less than 6 inches in depth, containing considerable aquatic flora and breeding no little natural food.

The following table gives the details of the food and cost of 28,000 rainbow trout raised at Neosho, Mo., Station, from fry to yearlings, on a mixed diet of beef, liver, and mush, commencing when the fry were transferred to the outdoor pools, April 1, 1892, and ending January 31, 1893:

Period.	Daily allowance.		Total for the month.	
	Liver.	Mush.	Liver.	Mush.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*
30 days of April	7·0	8·4	210·0	252·0
31 days of May	7·0	8·4	217·0	260·4
30 days of June	8·4	25·2	252·0	756·0
31 days of July	6·3	35·0	195·3	1,085·0
31 days of August	12·0	45·0	372·0	1,395·0
30 days of September	12·0	60·0	360·0	1,800·0
31 days of October	12·0	54·0	372·0	1,674·0
30 days of November	12·0	60·0	360·0	1,800·0
31 days of December	15·0	60·0	465·0	1,860·0
31 days of January	15·0	60·0	465·0	1,860·0
306 days			3,268·3	12,742·4

3,268·3 pounds of liver, at 3½ cents a pound, cost $114·39; 12,742·4 pounds of mush, at ¼ cent a pound, cost $31·86; cost of food for 28,000 rainbow trout from April 1 to January 31, $146·25.

Cost per 1,000, $5·22, or each fish cost a fraction over ½ cent. Average cost per day per 1,000 was 1·707 cents.

Average allowance per day (per 1,000) was 1·87 pounds of the mixture (in the proportion of 1 of liver to 3·79 of mush).

The fish were two sizes. On February 11, 1893, they were measured and weighed—

4 000 averaged 7 inches long and 107·5 pounds per 1,000, or	430 pounds gross.
24,000 averaged 5½ inches long and 42·5 pounds per 1,000, or	1,020 pounds gross.
28,000 yearlings weighed	1,452 pounds gross.

A cost per pound of a fraction over 10 cents.

Specimens of trout shipped from Neosho Station to Washington, D. C., January 25, 1892, to be cast for the World's Fair.

No. 1. Rainbow trout. Male fish. Hatched from eggs received from Wytheville Station in January, 1890. Weight, 30 ounces; age, 2 years.

No. 2. Same as No. 1. Weight, 21 ounces; age, 2 years.

No. 3. Brook trout. Hatched from eggs received from Northville Station January 25, 1891. Weight, 6 ounces; age 12 months.

No. 4. Same as No. 3. Weight, 6·5 ounces; age, 12 months.

No. 5. Von Behr (*S. fario*) trout. Hatched from eggs received from Northville Station February 5, 1891. Weight, 3·5 ounces; age, 11 months.

No. 6. Same as No. 5. Weight, 3·5 ounces; age, 11 months.

No. 7. Rainbow trout. Hatched from eggs received from Wytheville Station on January 17, 1891. Weight, 3 ounces; age, 12 months.

No. 8. Same as No. 7. Weight, 1·5 ounces; age, 12 months.

On February 11, 1893, at Neosho Station, the weighing of yearling rainbow trout showed that—

	Lbs.
100 of the largest, mush and liver fed, 7 inches long, weighed	10·75
100 medium size, mush and liver fed, 5·5 inches long, weighed	4·25
100 smallest size, fed on mush *only*, 4 inches long, weighed	2·75

The following table, showing the rainfall at Little Rock, Ark., by monthly averages, during the past fourteen years, from 1880 to 1893, inclusive, was prepared by the director of the U. S. Weather Bureau Station at that place:

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1880	4·64	7·95	7·60	4·69	2·44	3·23	3·37	5·53	5	2·07	6·84	3·03
1881	2·07	6·34	2·38	1·94	5·51	6·02	1·95	1·42	1·87	4·69	6·50	2·34
1882	8·17	12·74	6·25	5·59	15·91	1·96	5·17	3·17	3·03	6·05	6·17	1·33
1883	5·44	6·47	4·24	8·92	4·17	3·01	4·83	2·30	3·67	5·55	3·13	3·89
1884	3·45	9·79	4·67	10·24	7·33	2·18	4·23	3·26	5	1·30	2·83	16·92
1885	4·41	2·43	3·84	6·03	3·26	3·39	1·13	1·95	2·06	1·03	2·64	3·74
1886	3·97	4·27	3·45	3·09	1·13	9·28	2·97	5·31	6·24	1·07	5·81	·88
1887	2·26	6·42	4·54	·49	6·08	2·20	1·74	1·18	1·04	·97	4·50	7·14
1888	4·94	2·49	5·06	·84	5·09	7·25	3·78	11·13	1·33	2·39	8·82	4·43
1889	7·30	1·48	6·17	4·28	2·97	3·07	7·59	3·06	5·96	1·99	10·20	·14
1890	8·48	6·48	5·79	7·77	6·16	8·28	1·83	2·59	5·55	2·75	5·21	2·83
1891	7·68	3·99	5·48	3·29	2·38	2·81	9·23	2·66	·87	1·30	5·32	6·40
1892	3·92	3·44	2·55	7·53	9·62	2·48	3·10	6·63	3·54	2·82	8·02	8·48
1893	6·83	5·48	4·47	5·83	13·25	4·76	2·32	2·32	·73	·51	3·79	....

DETAILED ACCOUNT OF THE INVESTIGATIONS.

WHITE RIVER BASIN.

The White River has its origin in three branches which unite 8 or 10 miles east of Fayetteville. These branches are known as Main, Middle, and West Forks of White River. The Main Fork is the largest and is the only one deserving to be called a river. The West Fork is the smallest and is only a moderate-sized creek. These streams are all very similar in character. Their currents are very swift and their bottoms usually rocky or gravelly. All have their source in the northern slope of the Boston Mountains and drain, for the most part, a sandstone country. The general dip of the rocks in this region is too much to the south to be favorable to the formation of large springs. A number of springs are formed, but none are important. These streams become very low during the driest portion of the year, and the water in them is then confined to the deeper places in their beds, forming long, deep pools, with little or no running water between them. There are very few bayous formed in these river bottoms, and none of any size. Below the junction of these three forks the White River becomes a stream of some importance. It cuts through the cherty limestone previously mentioned, which forms its bed most of the distance to Newport, and it also drains most of the cherty limestone region in Arkansas and Missouri, as explained above. The river and its largest tributaries are fed by many spring brooks. At most places visited, viz, near Fayetteville, Eureka Springs, and Batesville, its bed is usually gravelly or sandy, with occasional stretches of rocky or muddy bottoms. Except a short time after a rainy season the water in the river is quite clear. Taken all together the White River is one of the clearest and most beautiful streams in the Mississippi basin.

King River was visited near Marble during the spring of 1892. It is a very clear stream, flowing over a sandy and shingly bottom. It is also fed by many springs in the cherty limestone through which it flows for the greater portion of its course.

The War Eagle is a tributary of the White River, some distance above King River, which it exceeds in size. It is reported to be the best stream for fish in northwestern Arkansas. It is not uncommon for anglers to cross the one or two forks of the White River and travel some 15 miles over a rough road in order to try their fortunes in the

War Eagle River. The black basses, called "trout," are the favorite fishes, although wall-eyed pike and channel cat are found in moderate quantities. No collections were made from this stream.

Near Batesville we visited three northern and one southern tributary of the White River. Laferty Creek is some 10 to 15 miles up the river from Batesville. It is a small stream, with clear water and a rocky, sandy, and muddy bottom. It is fed by springs and is too small to be of much importance. Spring Creek is about 10 to 12 miles in length, and is fed almost entirely by what is known as Big Spring. A short distance below the spring a dam is constructed, above which is a lake, about an eighth of an acre in extent. In the dry season, by storing water at night in this lake, enough water can be had to run an 8-horse-power turbine during the day. Below the spring the valley is narrow and subject to overflows; otherwise this would afford an excellent site for a hatchery. We collected in the stream below the dam and about half way from the dam to its mouth. Its water is very cool, especially when compared with the water in Laferty Creek, White River, and Polk Bayou. Polk Bayou is the largest tributary near Batesville. It is similar to Laferty and Spring Creek. Miller Creek is a small tributary of Polk Bayou. Salado is a small tributary on the south side of the river, a short distance below Batesville. The region drained is mostly covered by sandstone. Where visited by us the bottom was too rocky to admit of successful seining. A short distance below the water was very deep and full of large fragments of rock. Large gars could be seen coming occasionally to the surface. Between this point and its mouth the Salado flows through the White River bottom with a slow current in a deep, narrow channel. Caney Creek is a small tributary of the Salado near Batesville. It is similar to the Salado, though much smaller.

The next important tributary of White River is Black River, which empties into the White a short distance above Newport. The Black is a very large stream and navigable for small boats as far as Pocahontas, almost its entire length in Arkansas. The Current rivers, its most important tributaries, rise in southern and eastern Missouri. The waters of the Black River are quite clear, though they are stained to some extent apparently by vegetation, giving it a dark appearance, from which, no doubt, its name was derived. We visited this stream at Black Rock. It is from 50 to 200 yards in width and flows mostly through a deep channel, with sandy and muddy bottoms; along its course are many shoals with sandy and rocky bottoms. It is fed mostly by spring brooks and rivers, and is an excellent stream. The region about Black Rock is heavily timbered, pine, poplar, elm, oak, and ash being the commonest of the larger lowland trees. Black Rock is noted for its large number of sawmills.

Spring River is a western tributary of Black River, into which it empties a short distance above Black Rock. It is the outlet of Mammoth Spring, one of the largest springs in the United States, and is about half the size of Black River above the point where it enters. The current of Spring River is swift, its bottom more rocky and sandy than that of the White. Our collections were made a short distance above the mouth of the river.

The Strawberry is also a western tributary of the Black. It is little more than a large creek and goes nearly dry in summer. Its current is moderate, but rather swifter than that of Spring River, the bottom being more rocky. It was visited near Smithville. Flat and Machine creeks are small northern tributaries of the Strawberry. They dry up in summer and are too small to be of any consequence.

The Buffalo rivers are southern tributaries of the White River, and, no doubt, drain the roughest and most rugged portion of the Ozarks, if not the most elevated. The current of both these streams is swift and the bottom rocky. They were visited near Jasper and Loafer's Glory in the spring of 1892, when the water was too high to admit of successful collecting.

Village Creek is a small stream near Newport. It is so full of snags that collecting was almost impossible, and only a few common species were taken.

LIST OF THE FISHES OF THE WHITE RIVER BASIN.

1. **Lepisosteus osseus** (Linnæus). *Long-nosed Gar Pike; Common Gar Pike.* Common in White River at Batesville and Oxford Bend, and in Strawberry River at Smithville. Many large specimens of this species and the short-nosed forms were observed in White River at Newport; also in Salado Creek near Batesville.
2. **Polyodon spathula** (Walbaum). *Paddle-fish; Spoon-billed Cat.* White River at Oxford Bend; an occasional specimen taken.
3. **Ictalurus punctatus** (Rafinesque). *Channel Cat; White Cat.* Common in White River at Batesville, Strawberry River at Smithville, and in the Middle and Main Forks of White River at Fayetteville. Specimens can frequently be seen in the Fayetteville markets. Most of them are caught in fish-traps between Wyman and Oxford Bend.
4. **Ameiurus nigricans** (Le Sueur). *Great Catfish; Mississippi Cat.* A catfish weighing 67 pounds was caught in a fish-trap near Oxford Bend in the spring of 1892. I did not see it, but from what I learned about it I presume it belonged to this species. Other large catfishes are reported to have been caught in the White River near Fayetteville, and I have no doubt some of them belong to *Leptops olivaris.*
5. **Ameiurus nebulosus** (Le Sueur). *Common Bullhead; Horned Pout.* Miller Creek at Batesville; Black River at Black Rock. This species seems to be rare in the Ozark Mountain region.
6. **Ameiurus melas** (Rafinesque). *Bullhead.* Scarce in the White River and Polk Bayou at Batesville. but common in Spring Creek at the same place. Evidently more abundant than the preceding species.
7. **Noturus nocturnus** Jordan & Gilbert. A few small specimens from Spring River near Black Rock.
8. **Noturus gyrinus** (Mitchill). *Stone Cat.* A few specimens were obtained from Flat and Machine creeks at Smithville.
9. **Noturus miurus** Jordan. Thirty-seven specimens from the Middle Fork of White River, Fayetteville; 12 from the Main Fork; and 2 from White River at Oxford Bend. The longest is from Oxford Bend and measures $2\frac{1}{2}$ inches. Nearly all the others are from $1\frac{3}{4}$ to $2\frac{1}{4}$ inches in length; head, 4; depth, $5\frac{1}{2}$ to 6; anal rays, 11 to 13, usually 12; pectoral spine moderate; its length equal distance from tip of snout to posterior margin of orbit. On its inner margin are 6 retrorse spines; its outer margin smooth; occasionally one or two small spines on outer margin and near its tip. Top of head flattish, or slightly concave between orbits; mouth rather large. Origin of ventrals behind last dorsal rays. Color, light olivaceous, punctated with dark dots. Top of head darker; 4 dark bands on back, extending as faint bands on sides. Caudal fin with a dark band at its base, and one also near its tip. No dark spot on dorsal fin. These specimens differ from typical *miurus* in the smaller pectoral spine, with unserrated outer margin. It also has a more slender body.
10. **Noturus exilis** Nelson. Middle Fork of White River at Fayetteville (scarce).
11. **Noturus eleutherus** Jordan. One specimen from the Main Fork of White River at Fayetteville, and one from Sallisaw River near Makey's store. Length, $1\frac{3}{4}$ inches; head, $3\frac{1}{3}$; depth, 6; anal rays, 13. Pectoral spine large, 7 retrorse teeth on the inner margin, longer than the diameter of the spine; outer margin strongly toothed with from 18 to 25 teeth. The outer teeth are turned toward the tip of spine; those nearest base, toward base of spine, while those nearest the middle of the spine are directed at right angles to the spine. Mouth very small; head pointed; top of head convex. Origin of ventrals under last dorsal ray. Pectoral spine, $1\frac{1}{4}$ in the length of the head. Eye larger than in the preceding species. Color similar to *N. miurus.* A dark band across nape from one pectoral fin to the other; a dark band at base of dorsal fin, extending faintly on sides of body; 3 black bands behind dorsal fin; tip of caudal black.

12. **Ictiobus urus** (Agassiz). *Razor-back Buffalo.* I saw several large specimens of buffalo-fish in possession of fishermen near Batesville. They were caught on a hook baited with cotton and cornmeal. I was unable to identify the species with certainty. Buffalo-fish of large size are reported to be quite common in the White River.

13. **Catostomus nigricans** Le Sueur. *Hog Sucker; Stone-roller; Stone-toter.* This is a very common species in the Ozark Mountains, and seems to prefer clear streams. Rare in White River at Batesville, but abundant in Laferty and Spring creeks at Batesville, Black River and Spring River at Black Rock, Strawberry River at Smithville, Big Buffalo River and King River at Marble, middle and main forks of White River at Fayetteville.

14. **Erimyzon sucetta** (Lacépède). *Chub Sucker.* This species appears to be rare throughout the Ozarks. It is seldom taken except from stagnant ponds, bayous, or deep still water, in streams of rather small size. A few specimens were obtained at Batesville, from White River, Salado, Conley and Spring creeks.

15. **Moxostoma duquesnei** (Le Sueur). *Common Redhorse.* Common in White River, Polk Bayou, Salado, Caney and Spring creeks at Batesville; scarce in Village Creek at Newport; common in Black and Spring rivers at Black Rock, Strawberry River and Flat and Machine creeks at Smithville, Kings River at Marble, Middle and Main forks of the White River at Fayetteville. This species is easily confounded with ***P. carinatus*** Cope. In the White River basin it is the more common.

16. **Minytrema melanops** (Rafinesque). *Striped Sucker.* Obtained in Spring, Salado, and Caney creeks at Batesville, but only one specimen in each stream. This species is very scarce or very difficult to capture in our collecting seines. It seems to prefer still and deep water.

17. **Placopharynx carinatus** Cope. This species very much resembles *Moxostoma duquesnei.* It is more abundant in lowland than in mountain streams. A few specimens were taken in Black River at Black Rock.

18. **Cycleptus elongatus** (Le Sueur). *Missouri Sucker.* One large specimen was taken in Black River at Black Rock. This species lives in large streams and is difficult to capture. It is far from being abundant.

19. **Campostoma anomalum** (Rafinesque). *Stone-lugger; Stone-roller.* A very common and in some places a very abundant species in the Ozark region. It prefers spring brooks. Specimens were taken as follows: In the White River, Polk Bayou, Miller, Laferty, and Spring creeks at Batesville (common); Black and Spring rivers at Black Rock (scarce); Strawberry River, Flat and Machine creeks at Smithville, Big and Little Buffalo rivers at Jasper, and Middle and Main forks of the White River at Fayetteville (common).

20. **Hybognathus nuchalis** Agassiz. *Silvery minnow.* White River, Polk Bayou; Miller, Salado, and Caney creeks at Batesville (abundant); Laferty Creek at Batesville (common); Black and Spring River at Black Rock (scarce); Strawberry River at Smithville (scarce). The body of many of the specimens from Black Rock are more compressed than usual. A very abundant and variable minnow in the Ozarks.

21. **Hybognathus nubila** (Forbes). White River and Laferty Creek at Batesville (scarce); Big Buffalo River (common); King River at Marble (scarce); Main and Middle forks of White River at Fayetteville (abundant); West Fork of White River at Greenland (scarce).

22. **Chrosomus erythrogaster** Rafinesque. *Red-bellied minnow.* Spring Creek at Batesville (abundant); King River at Marble (common); Big Buffalo River and Little Buffalo River at Jasper (scarce). Very common in spring brooks throughout the Ozarks.

23. **Pimephales notatus** (Rafinesque). *Blunt-nosed Minnow.* White River and Polk Bayou at Batesville (scarce); Salado, Caney, and Laferty creeks at Batesville (common); Strawberry River, Flat and Machine creeks at Smithville; Big Buffalo River at Jasper (scarce); King River at Marble and Spring River at Black Rock (common); West Fork of White River at Greenland and White River at Oxford Bend (scarce); Main and Middle forks of White River at Fayetteville (abundant).

24. **Cliola vigilax** Girard. Taken in White River, Salado and Caney creeks at Batesville, and in Black River at Black Rock; but scarce at all of these places.

25. **Notropis blennius** (Girard). *Blunt-nosed Minnow.* Black River and Spring River at Black Rock. The types (2 specimens) of *Notropis* (*Moniana*) *deliciosus* are from Rio Leon, near San Antonio, Tex., and are preserved in the U. S. National Museum. The types of *Notropis*

(Alburnops) blennius are from Arkansas River near Fort Smith. The specimens listed above are identical with *N. blennius*. The types of *N. deliciosus* differ in being a little more slender and in having a more pointed snout and smaller preorbital bone. *N. blennius* is the older name and should be used for this species; *N. deliciosus* representing the most southern variety of this exceedingly variable species.

26. **Notropis ozarcanus** Meek. Salado and Caney creeks at Batesville; Strawberry River at Smithville (scarce).

27. **Notropis shumardi** (Girard).

Notropis (Alburnops) shumardi Girard, Proc. Acad. Nat. Sci. Phila. 1856, 194 (Arkansas River at Fort Smith, types); Girard, Fishes Pacific R. R. Survey, 1858, 261 (Arkansas River at Fort Smith, types).

Notropis boops Gilbert, Proc. U. S. Nat. Mus. 1884, 201 (Salt Creek, Brown County, Ind., and Flat Rock Creek, Rush County, Ind., types).

Notropis scabriceps Jordan & Gilbert, Proc. U. S. Nat. Mus. 1885 (White River, Eureka Springs, Ark., in part).

The types of *Alburnops shumardi* Girard have never been found. His description and figure would suggest *Notropis boops* Gilbert, rather than any other species so far known from western Arkansas, unless it be one of the other species figured on same page of Dr. Girard's paper, *Alburnops blennius* or *Alburnops illecebrosus*. *Notropis boops* Gilbert, is a very common species in the Ozark Mountain region, and it seems not unlikely to have been in Dr. Girard's collection. *Alburnops blennius* and *illecebrosus* of Girard are distinct species and different from *Notropis boops* of Gilbert. The specimens from White River, Eureka Springs, recorded by Drs. Jordan and Gilbert as *Notropis scabriceps*, are for the most part the *N. boops* of Gilbert. A few specimens are *N. arcansanus* Meek. The description evidently is that of *N. boops* Gilbert, which is here regarded as identical with *Notropis shumardi* (Girard). White River and Polk Bayou, Batesville, scarce; Black River.

28. **Notropis whipplei** (Girard). *Silver-fin.* Common in White River, Polk Bayou; Miller, Salado, and Caney creeks at Batesville; Strawberry River at Smithville, and in the main and middle forks of White River at Fayetteville; scarce in Laferty Creek at Batesville.

29. **Notropis venustus** (Girard). *Black-tailed Minnow.* White River at Batesville (scarce); Polk Bayou and Miller Creek at Batesville (common); Black and Spring rivers at Black Rock (abundant).

30. **Notropis xænocephalus** (Jordan). Scarce in White River at Batesville and Spring River at Black Rock; common in Black River at Black Rock. This species resembles *N. shumardi*, but has a smaller eye, dorsal fin more posterior, and a small black spot at the base of the caudal fin. The specimens recorded as *N. shumardi*, in the Bulletin of the U. S. Fish Commission for 1889, p. 121, with small black spot at base of caudal, belongs to this species. I have recently compared these specimens with the types of *N. xænocephalus* in the U. S. National Museum at Washington, and find no difference except such as would be expected among specimens preserved in alcohol.

31. **Notropis cornutus** (Mitchill). *Common Shiner.* Polk Bayou, Laferty and Spring creeks at Batesville (abundant); Salado and Caney creeks at Batesville; Black River at Black Rock (common); Spring River at Black Rock; Strawberry River, Flat and Machine creeks at Smithville; King River at Marble; Big Buffalo River (scarce); Little Buffalo River, Jasper (common); Main and Middle forks of White River, Fayetteville (abundant). It is difficult to distinguish the young of this species from the young of *Notropis zonatus*. This species is the more common in ordinary streams, the other is found more in spring brooks.

32. **Notropis zonatus** (Agassiz). White River, Polk Bayou, and Laferty Creek at Batesville; Black River and Spring River at Black Rock (scarce); King River at Marble (common); Middle Fork of White River at Fayetteville and Big Buffalo River (abundant).

33. **Notropis umbratilis** (Girard). White River, Polk Bayou, Salado, Caney, and Spring creeks at Batesville (scarce); Flat and Machine creeks at Smithville (common). This minnow is extremely variable in form and color. Some individuals have a very deep and much compressed body, and the deeper specimens are usually the darkest in color.

34. **Notropis galacturus** (Cope). *Milky-tailed Minnow.* Polk Bayou and Laferty Creek at Batesville (scarce); Spring River at Black Rock and Strawberry River at Smithville (common); Main Fork of White River at Fayetteville (scarce).

35. **Notropis telescopus arcansanus** (Meek). This species is scarce in Laferty, Salado, and Caney creeks at Batesville, Strawberry River at Smithville, and the Main and Middle forks of the White River at Batesville; but is abundant in Little Buffalo River at Jasper and Big Buffalo River. Many females taken from the Little Buffalo River were full of mature eggs. Their breeding season seems to be about the last of May or first of June.

36. **Notropis atherinoides caddoënsis** (Meek). Taken in White River and Miller Creek (common); Polk Bayou and Laferty Creek (abundant) and Salado and Caney creeks (scarce) at Batesville; Village Creek at Newport and Spring River at Black Rock (abundant); Black River at Black Rock (common).

37. **Notropis dilectus** (Girard). *Emerald Minnow.* White River at Batesville (abundant); Polk Bayou at Batesville (common); Laferty, Salado, and Caney creeks at Batesville, Black and Spring rivers at Black Rock, and Middle Fork of the White River at Batesville (scarce).

38. **Hybopsis dissimilis** (Kirtland). *Spotted Minnow.* White River at Batesville (scarce).

39. **Hybopsis amblops** (Rafinesque). White River and Polk Bayou at Batesville (scarce); Big Buffalo River (common); Little Buffalo River at Jasper (abundant); Strawberry River at Smithville; West Fork of White River at Greenland; Main and Middle forks of the White River at Fayetteville (scarce).

40. **Hybopsis kentuckiensis** (Rafinesque). *Horny-headed Minnow.* Taken at Batesville in Laferty Creek (scarce); Spring Creek (common).

41. **Semotilus atromaculatus** (Mitchill). *Horned Dace; Creek Chub.* Polk Bayou and Laferty Creek at Batesville (scarce); Spring Creek at Batesville; Flat and Machine creeks at Smithville (common); Big Buffalo River (scarce); King River at Marble.

42. **Notemigonus chrysoleucus** (Mitchill). *Golden Shiner.* White River and Polk Bayou at Batesville (scarce); Salado, Caney, and Spring creeks at Batesville (common).

43. **Opsopœodus emiliæ** (Hay). Salado and Caney creeks at Batesville (scarce). Teeth, 5-5; scales, 41. No black on dorsal fin; due, no doubt, to the specimen having faded.

44. **Dorosoma cepedianum** (Le Sueur). *Gizzard Shad; Hickory Shad.* White River at Batesville, Black River at Black Rock; White River at Oxford Bend; scarce at all of these places.

45. **Clupea chrysochloris** (Rafinesque). *Skipjack.* White River at Batesville (scarce).

46. **Fundulus catenatus** (Storer). *Studfish.* White River and Polk Bayou at Batesville (scarce); Spring River at Black Rock; Flat and Machine creeks at Smithville (common); King River at Marble; Big Buffalo River (abundant); West Fork of White River at Greenland; Main and Middle forks of White River at Fayetteville (scarce).

47. **Zygonectes notatus** (Rafinesque). *Top-minnow.* White River, Polk Bayou, Salado and Caney creeks at Batesville (common); Laferty and Spring creeks at Batesville (scarce); Village Creek at Newport and Black River at Black Rock (common); Spring River at Black Rock (scarce); Strawberry River; Flat and Machine creeks at Smithville (common); Main and Middle forks of White River at Fayetteville (common).

48. **Gambusia affinis** (Baird & Girard). Polk Bayou at Batesville (common); Spring Creek at Batesville (abundant); Black and Spring rivers at Black Rock (common); Strawberry River at Smithville (abundant); Salado and Caney creeks at Batesville (scarce). Many of the females were full of young, especially those from Spring Creek, taken the second week in August.

49. **Lucius vermiculatus** (Le Sueur). *Little Green Pickerel.* Spring Creek at Batesville and Black River at Black Rock (common).

50. **Lucius reticulatus** (Le Sueur). *Eastern Pickerel.* Spring Creek at Batesville, not common. A few specimens were taken from a deep hole in the stream.

51. **Anguilla chrysypa** Rafinesque. *Common Eel.* Black River at Black Rock. One specimen was taken on the shoals, a short distance above the city. White River at Oxford Bend (scarce).

52. **Labidesthes sicculus** (Cope). *Brook Silverside.* White River, Polk Bayou, Salado and Caney creeks at Batesville (scarce); Village Creek at Newport (common); Spring River at Black Rock (scarce); Black River at Black Rock; Strawberry River at Smithville (common); Big Buffalo River (scarce); King River at Marble and Main and Middle forks of White River at Fayetteville (scarce).

53. **Aphredoderus sayanus** (Gilliams). *Pirate Perch.* Spring Creek at Batesville and Black River at Black Rock (scarce).

54. **Elassoma zonatum** Jordan. Spring Creek at Batesville (scarce).

55. **Ambloplites rupestris** (Rafinesque). *Goggle-eye; Rock Bass.* Black River at Black Rock (scarce).

56. **Pomoxis sparoides** (Lacépède). *Calico Bass.* Black River at Black Rock.

57. **Lepomis cyanellus** Rafinesque. *Green Sunfish; Perch.* White River and Spring Creek at Batesville (common); Laferty Creek at Batesville; Black River at Black Rock (scarce); Strawberry River, Flat and Machine creeks at Smithville (common); Big Buffalo River (abundant); King River at Marble and Main and Middle forks of White River at Fayetteville (scarce). The species of sunfishes, more especially those belonging to the genus *Lepomis*, are known in Arkansas as "perch."

58. **Lepomis macrochirus** (Rafinesque). Taken in the White River, Spring, Salado, and Caney creeks at Batesville, and in Black River at Black Rock, but scarce at all these places.

59. **Lepomis garmani** Forbes. Obtained in Salado, Caney, and Spring creeks at Batesville, and in Black River at Black Rock; scarce at all of these places. Probably identical with *L. miniatus.*

60. **Lepomis pallidus** (Mitchill). *Blue Sunfish; Perch.* White River at Batesville (scarce); Village Creek at Newport; Black and Spring rivers at Black Rock (common).

61. **Lepomis megalotis** (Rafinesque). *Long-eared Sunfish; Perch.* White River and Laferty Creek at Batesville (scarce); Salado and Caney creeks at Batesville; Black and Spring rivers at Black Rock; Strawberry River at Smithville (common); Flat and Machine creeks at Smithville, King River at Marble, and Big Buffalo River (scarce); Main and Middle forks of White River at Fayetteville (abundant).

62. **Micropterus salmoides** (Lacépède). *Big-mouthed Black Bass; Trout.* White River and Polk Bayou at Batesville (common); Salado and Caney creeks at Batesville (scarce); Black and Spring rivers at Black Rock; Strawberry River at Smithville (common); Village Creek at Newport (scarce); Main and Middle forks of White River at Fayetteville (common).

63. **Micropterus dolomieu** Lacépède. *Small-mouthed Black Bass; Trout.* White River and Laferty Creek at Batesville; Strawberry River at Smithville; Main and Middle forks of White River at Fayetteville (common). Both this and the preceding species are known in the South as "trout."

64. **Etheostoma pellucidum vivax** (Hay). *Sand Darter.* White River at Batesville (common); Polk Bayou and Miller Creek at Batesville; Strawberry River at Smithville (scarce). In these specimens the body is covered with scales except on the belly and anterior dorsal region. The rest of the dorsal region is loosely scaled.

65. **Etheostoma nigrum** Rafinesque. Polk Bayou; Salado and Caney creeks at Batesville; Strawberry River at Smithville (scarce).

66. **Etheostoma chlorosoma** (Hay). Spring River and Black River at Black Rock (scarce).

67. **Etheostoma blennioides** Rafinesque. *Green-sided Darter.* White River at Batesville; Black River at Black Rock; Strawberry River; Flat and Machine creeks at Smithville (scarce); Big Buffalo River (common).

68. **Etheostoma caprodes** (Rafinesque). *Hogfish; Log Perch.* White River at Batesville; Black and Spring rivers at Black Rock; Middle and Main forks of White River at Fayetteville (scarce); Strawberry River at Smithville (common).

69. **Etheostoma aspro** (Cope & Jordan). *Black-sided Darter.* White River at Batesville (scarce); Salado and Caney creeks at Batesville (common); Black and Spring rivers at Black Rock (scarce); Strawberry River at Smithville (common).

70. **Etheostoma phoxocephalum** Nelson. White River at Batesville; Spring River at Black Rock; Strawberry River at Smithville (scarce).

71. **Etheostoma evides** (Jordan & Copeland). Spring River at Black Rock; Strawberry River at Smithville; Black River at Black Rock (scarce).

72. **Etheostoma cymatotænia** Gilbert & Meek. Salado and Caney creeks (scarce).

73. **Etheostoma ouachitæ** (Jordan & Gilbert). Black River at Black Rock. Two specimens were obtained. Head, 4; depth, 6½; dorsal fin, X–13; anal fin, II–10; scales, 6–58–7; lateral line complete. Breast and nape naked, cheeks and opercles scaled. Scales on belly deciduous, leaving a naked strip. Gill membrane scarcely connected, free from the isthmus. Snout pointed, mouth terminal; jaws equal and well supplied with teeth. Upper jaw with frenum scarcely protractile. Color similar to *E. aspro;* spots on sides confluent and irregular. All of the fins are barred with darker except ventrals and anal. Body very slender, subterete.

74. **Etheostoma zonale** (Cope). Polk Bayou and Spring Creek at Batesville; Black River at Black Rock (scarce); Spring River at Black Rock (common); White River, Oxford Bend, and Main and Middle forks of White River at Fayetteville (scarce).

75. **Etheostoma whipplei** (Girard). Polk Bayou, Salado and Caney creeks at Batesville; Spring River at Black Rock (scarce).

76. **Etheostoma histrio** (Jordan & Gilbert). Black River at Black Rock, one specimen. Length, head, $4\frac{1}{2}$; depth, $5\frac{1}{4}$; dorsal, IX-12; anal, II-7; scales, 5-56-7. Nape well scaled. Cheeks naked; opercles with a few scales on the upper portion. Breast and anterior portion of belly naked; rest of belly with ordinary scales. Body very robust; dorsal region elevated; snout blunt, sharply decurved; mouth small, subinferior, lower jaw included; upper jaw slightly protractile; teeth in jaws well developed. Color very dark, mottled; spinous dorsal with dark band across tops of spines and extending down on front of fin; soft dorsal, with black dots, irregularly barred; anal and paired fins barred.

77. **Etheostoma uranidea** (Jordan & Gilbert). White River at Batesville; Black and Spring rivers at Black Rock (common).

78. **Etheostoma juliæ** Meek. King River at Marble; Middle Fork of White River at Fayetteville (scarce). Known only from these specimens and the types which were obtained from James River near Springfield, Mo.

79. **Etheostoma cœruleum spectabile** (Agassiz). *Rainbow Darter.* Polk Bayou (scarce); Miller Creek (common); Laferty and Spring creeks, at Batesville (abundant); Spring River at Black Rock; Flat and Machine creeks at Smithville (common); Big Buffalo River (abundant); Little Buffalo River at Jasper; King River at Marble; White River at Oxford Bend; West Fork of White River at Greenland; Middle and Main forks of White River at Fayetteville (common). This is the most abundant of the darters in the Ozark Mountain region.

80. **Etheostoma iowæ** Jordan & Meek. Little Buffalo River at Jasper. Three specimens were obtained. Head, 4 in the length of the body; depth, $5\frac{3}{4}$ to 6; dorsal, IX or X-10 or 11; anal, II-7 or 8; scales in the lateral line 54 to 58. Nape, cheeks, opercles, and breast scaly; breast partially naked; belly entirely scaled with ordinary scales; body slender, not much compressed; snout bluntish; mouth little oblique, large, maxillary reaching pupil of eye; jaws equal; gill membranes not broadly united, free from the isthmus; upper jaw slightly protractile, maxillary free from the preorbital. Eye large, $3\frac{1}{3}$ in head; interorbital width 2 in eye. Lateral line incomplete, terminating about half way. Color olivaceous, mottled with darker. Nine blackish (irregular) spots on sides. Six dark bands across the back. Dorsal and caudal fins barred; ventrals dark, other fins light. *E. iowæ* is a very variable darter. The specimens here described differ somewhat in form and coloration from specimens from the northwest. The range known at present is Iowa and Nebraska to British Columbia. I am inclined to consider these specimens as *E. iowæ*, regarding the difference here recorded as seasonal. These specimens were taken in the spring, evidently near the breeding season; other specimens I have examined were collected in the summer and fall.

81. **Etheostoma saxatile** (Hay). Village Creek at Newport; Strawberry River at Smithville; Main and Middle forks of White River at Fayetteville; Black River at Black Rock; Polk Bayou at Batesville (scarce); Spring River at Black Rock (common).

82. **Etheostoma punctulatum** (Agassiz). Main fork of White River at Fayetteville. Only 2 small specimens obtained; apparently very scarce.

83. **Roccus chrysops** (Rafinesque). *Striped Bass.* White River at Batesville (common). This species is reported as being quite common in the White River near Batesville. It is a favorite with hook-and-line sportsmen.

84. **Cottus bairdi** Girard. *Miller's Thumb; "Cod"; Blob.* Polk Bayou and Spring Creek at Batesville (common); Spring River at Black Rock (scarce); King River at Marble and Big Buffalo River (common); Little Buffalo River at Jasper (scarce).

LITTLE RED RIVER BASIN.

Little Red River belongs to the eastern slope of the Ozark Mountains. It was visited near Heber and Judsonia. At the former place the bottom is very rocky and the current swift. A heavy rainfall in the upper part of its basin had caused the water to rise in the river to such an extent as to render our efforts at collecting less successful than they otherwise would have been. A few fishes were obtained from a small creek on the north side of the river. At Judsonia the current is sluggish, the water usually deep, and the bottom muddy. A short distance above the city are some shoals with rocky and sandy bottom. Our collections were made at this point.

We also visited three tributaries of the Little Red River near Kinderhook and Shiloh, namely, Devil's Fork, North and West forks. These streams were very rocky and seining in them was difficult. They were cut in many places, so as to form deep, wide holes, which seemed full of fish life, sunfishes being especially abundant. Of all the streams seen by me in the Ozark region these seemed to have the largest and deepest holes, the one on North Fork near the crossing of the Kinderhook road being large enough to be called a lake. Its depth is said to be over 25 feet in times of low water. These long, deep holes excavated in the beds of streams seem to be very characteristic of the Ozark Mountain rivers.

The region drained by these three branches is very thinly populated, and the fishes in the streams appear to have been but little disturbed by man.

Bull Creek is a small stream draining a comparatively low and level region. It contained very little water when seen by us and was full of snags and cypress knees. Our collecting was mostly done near the railroad, in some holes which receive overflow water from the creek during most of the heavy rains each year.

LIST OF THE FISHES OF THE LITTLE RED RIVER BASIN.

1. **Lepisosteus osseus** (Linnæus). *Common Gar Pike; Long-nosed Gar.* Common in the Little Red River at Judsonia.
2. **Lepisosteus platystomus** Rafinesque. *Short-nosed Gar Pike.* Little Red River at Judsonia (scarce).
3. **Amia calva** Linnæus. *Dogfish; "Grindle."* Bull Creek at Beebe (abundant). Many specimens of this species were taken from some large ponds near the railroad.
4. **Ameiurus melas** (Rafinesque). *Bullhead.* Little Red River at Heber (not common); Bull Creek at Beebe (abundant).
5. **Ameiurus nebulosus** (Le Sueur). *Common Bullhead.* South Fork of Little Red River at Kinderhook (scarce).
6. **Ictalurus punctatus** (Rafinesque). *Channel Cat; White Cat.* Little Red River at Judsonia (common).
7. **Ictiobus bubalus** (Rafinesque). *Buffalo.* Little Red River at Judsonia, scarce. Head, 4; depth, $2\frac{1}{3}$; dorsal rays, 26; anal rays, 8; scales, 9–38–6; lateral line straight; lips thick, the margin of the lower jaw forming an acute angle. Color dark.
8. **Carpiodes velifer** (Rafinesque). *Quillback.* Little Red River at Judsonia (common).
9. **Catostomus nigricans** (Le Sueur). *Hog Sucker; Mullet.* Little Red River at Heber; Devil's Fork at Shiloh; Middle Fork and South Forks at Kinderhook (scarce).
10. **Moxostoma duquesnei** (Le Sueur). *Common Redhorse.* Little Red River at Heber (scarce); at Judsonia (common); Devil's Fork at Shiloh; Middle Fork at Kinderhook (common); South Fork at Kinderhook (scarce).
11. **Minytrema melanops** (Rafinesque). *Striped Sucker.* Bull Creek at Beebe (scarce).
12. **Erimyzon sucetta** (Lacépède). *Chub Sucker.* Little Red River at Heber (common); South Fork at Kinderhook (scarce); Bull Creek at Beebe (abundant).

13. **Placopharynx carinatus** (Cope). Little Red River at Heber and Devil's Fork at Shiloh (common).
14. **Campostoma anomalum** (Rafinesque). *Stone-roller.* Little Red River at Heber and Devil's Fork at Shiloh (scarce); Middle and South forks at Kinderhook (common).
15. **Hybognathus nuchalis** Agassiz. *Silver-fish.* Little Red River at Heber and Judsonia; Middle Fork at Kinderhook (scarce).
16. **Pimephales notatus** (Rafinesque). *Blunt-nosed Minnow.* Little Red River at Heber and Devil's Fork at Shiloh (common); South Fork at Kinderhook (scarce).
17. **Pimephales promelas** Rafinesque. *Flathead Minnow.* Little Red River at Heber and Middle Fork at Kinderhook (common); South Fork at Kinderhook (scarce).
18. **Notropis heterodon** (Cope). Little Red River at Heber (scarce).
19. **Notropis xænocephalus** (Jordan). Devil's Fork at Shiloh (common); Middle Fork at Kinderhook; Little Red River at Judsonia (scarce).
20. **Notropis shumardi** (Girard). Little Red River at Heber (abundant); Devil's Fork at Shiloh; Middle and South forks at Kinderhook (common).
21. **Notropis galacturus** (Cope). *Milky-tailed Minnow.* Middle Fork at Kinderhook (scarce).
22. **Notropis whipplei** (Girard). *Silver-fin.* Little Red River at Heber (common) and Judsonia (scarce); Devil's Fork at Shiloh (scarce); Middle and South forks at Kinderhook (abundant).
23. **Notropis venustus** (Girard). *Black-tailed Minnow.* Little Red River at Heber and Judsonia; Middle Fork at Kinderhook; Devil's Fork at Shiloh (scarce).
24. **Notropis umbratilis** (Girard). Little Red River at Judsonia; Middle Fork at Kinderhook (scarce).
25. **Notropis dilectus** (Girard). *Emerald Minnow.* Little Red River at Heber (scarce.)
26. **Notropis atherinoides caddoënsis** Meek. Little Red River at Heber (scarce) and Judsonia (common); Middle Fork at Kinderhook (abundant).
27. **Notropis cornutus** (Mitchill). *Common Shiner.* Bull Creek at Beebe (scarce).
28. **Hybopsis watauga** (Jordan & Evermann). Four specimens from the South Fork of the Little Red River at Kinderhook. Length of longest specimen, $2\frac{3}{4}$ inches; head, $4\frac{2}{5}$; depth, 6; D. 8, A. 7; scales, 7–52–6; (vertical rows counted from dorsal to ventral fins); lateral line on the 7th row. First dorsal ray nearer tip of snout than base of caudal fin by nearly two-fifths length of head. About 23 scales before dorsal. Body long and slender. Snout rather long; less blunt than in *H. amblops*. Eye medium, its diameter equaling the length of snout, three in head. Ventrals have their origin under vertical from first dorsal rays; barbels small. A dusky lateral band, very little silvery reflection; above lateral band a lighter olivaceous band about as wide as lateral band. Dorsal region dusky. Belly olivaceous. Differs from typical *watauga* somewhat in coloration and in being more slender, but agrees with it in other respects.
29. **Hybopsis storerianus** (Kirtland). Middle Fork of Little Red River at Kinderhook (scarce).
30. **Semotilus atromaculatus** (Mitchill). *River Chub.* South Fork at Kinderhook.
31. **Notemigonus chrysoleucus** (Mitchill). *Golden Shiner.* Little Red River at Judsonia (common); Bull Creek at Beebe (abundant).
32. **Dorosoma cepedianum** (Le Sueur). *Gizzard Shad; Hickory Shad.* Little Red River at Heber (scarce) and Judsonia (common); Bull Creek at Beebe (abundant).
33. **Clupea chrysochloris** (Rafinesque). *Skipjack.* Little Red River at Judsonia (common).
34. **Zygonectes notatus** (Rafinesque). *Top-minnow.* Little Red River at Heber and Judsonia; Devil's Fork at Shiloh; Middle and South forks at Kinderhook (common).
35. **Lucius vermiculatus** (Le Sueur). *Little Pickerel.* Little Red River at Heber (scarce) and Judsonia (common); Bull Creek at Beebe (common).
36. **Lucius reticulatus** (Le Sueur). *Eastern Pickerel.* Little Red River at Heber (common).
37. **Labidesthes sicculus** (Cope). *Brook Silverside.* Little Red River at Heber (abundant) and Judsonia (common); Devil's Fork at Shiloh (common); Middle and South forks at Kinderhook (scarce).
38. **Pomoxis sparoides** (Lacépède). *Calico Bass.* Little Red River at Judsonia (common).
39. **Centrarchus macropterus** (Lacépède). Bull Creek at Beebe (common).
40. **Ambloplites rupestris** (Rafinesque). *Rock Bass.* Little Red River at Heber and Devil's Fork at Shiloh (scarce); Middle Fork at Kinderhook (common).
41. **Lepomis cyanellus** Rafinesque. *Green Sunfish; "Perch."* South Fork at Kinderhook (common).

42. **Lepomis macrochirus** (Rafinesque). *"Perch."* Devil's Fork of Little Red River (scarce).

43. **Lepomis pallidus** (Mitchill). *Blue Sunfish.* Little Red River at Heber and Judsonia (common); Devil's Fork at Shiloh and Middle Fork at Kinderhook (scarce); Bull Creek at Beebe (abundant).

44. **Lepomis humilis** (Girard). *Red-spotted Sunfish; "Perch."* Little Red River at Heber (scarce)

45. **Lepomis megalotis** (Rafinesque). *Long-eared Sunfish; "Perch."* Little Red River at Heber (abundant) and Judsonia (common); Devil's Fork at Shiloh (scarce); Middle and South forks at Kinderhook (abundant); Bull Creek at Beebe (abundant).

46. **Micropterus salmoides** (Lacépède). *Big-mouthed Black Bass; "Trout."* Little Red River at Heber and Judsonia (common); Middle and South forks at Kinderhook (scarce).

47. **Micropterus dolomieu** Lacépède. *Small-mouthed Black Bass; Trout.* Little Red River at Heber (abundant) and Judsonia (common); Devil's Fork at Shiloh and Middle Fork at Kinderhook (common); South Fork at Kinderhook (scarce).

48. **Etheostoma pellucidum vivax** (Hay). *Sand Darter.* Little Red River at Judsonia; Middle Fork at Kinderhook (scarce).

49. **Etheostoma blennioides** Rafinesque. *Green-sided Darter.* Middle and South forks at Kinderhook (scarce).

50. **Etheostoma caprodes** (Rafinesque). *Hogfish.* Little Red River at Heber (scarce).

51. **Etheostoma aspro** (Cope & Jordan). *Black-sided Darter.* Little Red River at Judsonia (scarce).

52. **Etheostoma phoxocephalum** (Nelson). Middle Fork at Kinderhook (scarce).

53. **Etheostoma cœruleum spectabile** (Agassiz). *Rainbow Darter.* Middle and South forks at Kinderhook (scarce).

54. **Etheostoma whipplei** (Girard). South Fork at Kinderhook (scarce).

55. **Etheostoma zonale** (Cope). Middle and South forks at Kinderhook (scarce).

56. **Etheostoma saxatile** Hay. South Fork at Kinderhook; Little Red River at Judsonia (scarce).

57. **Etheostoma microperca** Jordan & Gilbert. *Least Darter.* Little Red River at Heber (scarce).

58. **Aplodinotus grunniens** (Rafinesque). *Fresh-water Drum.* Little Red River at Judsonia (scarce).

THE ARKANSAS RIVER BASIN.

The Arkansas River was visited at Little Rock, Mulberry, and Fort Smith. The water of this river is seldom, if ever, clear, and the fishes taken from it have that pale, sickly color so characteristic of the fishes of the Platte and Missouri rivers. The species of smaller fishes seem very scarce.

The Chadron is a northern tributary of the Arkansas near Conway. It is a small stream, flowing over a rocky bottom until it reaches the lowlands along the Arkansas River, where it continues with a sluggish current in a deeper channel. We visited this stream near Pinnacle Springs. Its bottom was very rocky and the current swift.

Cove Creek, a western tributary, was visited near Martinsville. It is similar to the main river, though less rocky, and the current less swift.

East Fork near Conway is a sluggish creek with very muddy bottom, similar to the lower Chadron.

Illinois River (Russellville) and Mulberry River resemble very closely the Chadron, as does also the Big Piney. We collected in the Walnut Fork of Big Piney near Swain, in Illinois River near Russellville, and in the Mulberry near Mulberry. All of these streams drain a sandstone region.

Sallisaw River is a northern tributary of the Arkansas, about 50 miles west of Fort Smith. It drains mostly a limestone region, is well fed by springs, and where visited (near Makey's store) has a sandy and gravelly bottom. It is very similar to the Illinois River, which is only a few miles west of it.

LIST OF THE FISHES OF THE ARKANSAS RIVER BASIN.

1. **Petromyzon concolor** (Kirtland). *River Lamprey.* One small specimen (larval) of this species was taken in Sallisaw River, near Makey's store.

2. **Lepisosteus osseus** (Linnæus). *Common Gar-Pike; Long-nosed Gar.* Common in Arkansas River at Little Rock and Mulberry, and in the East Fork of Chadron at Conway. The negroes along the Arkansas River eat this and the following species, some of them expressing a preference for gars over catfishes. All the gars we took at Mulberry were carried off by negroes for food.

3. **Lepisosteus platystomus** Rafinesque. *Short-nosed Gar-Pike.* East Fork of Chadron at Conway (scarce).

4. **Ictalurus furcatus** (Cuvier & Valenciennes).

5. **Ictalurus punctatus** (Rafinesque). *Channel Cat; White Cat.* Arkansas River at Little Rock (abundant) and Mulberry (common); Mulberry River at Mulberry (common).

6. **Leptops olivaris** (Rafinesque). *Mud Cat; Flathead Cat.* Arkansas River at Little Rock and Mulberry and Cove Creek at Martinsville (scarce).

7. **Ameiurus melas** (Rafinesque). *Bullhead.* East Fork of Chadron at Conway (scarce); Sallisaw River at Makey's store (common).

8. **Noturus eleutherus** Jordan. *Stone Cat.* Sallisaw River at Makey's store (scarce).

9. **Ictiobus velifer** (Rafinesque). *Quillback; Carp Sucker.* Arkansas River at Little Rock and Mulberry; East Fork of Chadron at Conway; Sallisaw River at Makey's store (common). In specimens from East Fork of Chadron, at Conway, the dorsal rays are 24; scales, 37. A specimen from the Arkansas River has dorsal 25; scales, 6–37–5; head, $4\frac{3}{5}$; depth, 3; color, silvery. In all specimens the lips are thin, the under jaws making an obtuse angle.

10. **Ictiobus urus** (Agassiz). *Razor-back Buffalo.* Arkansas River at Little Rock. Lips thick; the lower jaw forming an acute angle. D. 25; A. 7; scales, 7–37–5; head, 4; depth, $2\frac{3}{5}$; color darker and less silvery than in preceding species. Illinois River at Russellville (scarce). Similar to the above in appearance. Scales, 6-38–5; head, $3\frac{4}{5}$; depth, 3; silvery.

11. **Catostomus nigricans** Le Sueur. *Hog Sucker; Stone-roller.* Cove Creek at Martinsville; Mulberry River at Mulberry and Sallisaw River at Makey's store (common).

12. **Erimyzon sucetta** (Lacépède). *Chub Sucker.* Illinois River at Russellville and Sallisaw River at Makey's (scarce).

13. **Moxostoma duquesnei** (Le Sueur). *Common Redhorse; White Sucker.* Cove Creek at Martinsville (abundant); Illinois River at Russellville (scarce); Sallisaw River at Makey's (abundant).

14. **Minytrema melanops** (Rafinesque). *Striped Sucker.* Illinois River at Russellville (scarce).

15. **Placopharynx carinatus** Cope. Cove Creek at Martinsville and Mulberry River at Mulberry (scarce); Sallisaw River at Makey's (abundant). This sucker so resembles the redhorse that fishermen know it by the same name.

16. **Campostoma anomalum** (Rafinesque). *Stone-Lugger; Stone-Roller.* Cove Creek at Martinsville (common); Illinois River at Russellville (scarce); Mulberry River at Mulberry (abundant); Sallisaw River at Makey's (scarce).

17. **Hybognathus nubila** (Forbes). Sallisaw River at Makey's (common).

18. **Hybognathus nuchalis** Agassiz. *Silvery Minnow.* Arkansas River at Little Rock and Mulberry (abundant); East Fork Chadron at Conway (common); Illinis River at Russellville (scarce); Sallisaw River at Makey's (common).

19. **Pimephales notatus** (Rafinesque). *Blunt-nosed Minnow.* Cove Creek at Martinsville; Illinois River at Russellville and Mulberry River at Mulberry (common); Sallisaw River at Makey's (abundant).

20. **Pimephales promelas** Rafinesque. *Flat-head Minnow.* Illinois River at Russellville (scarce).

21. **Cliola vigilax** Girard. Arkansas River at Little Rock and East Fork of the Chadron at Conway (common).

22. **Notropis blennius** (Girard). Arkansas and Mulberry rivers at Mulberry (scarce).

23. **Notropis shumardi** (Girard). Arkansas River at Mulberry and Cove Creek at Martinsville (scarce); Illinois River at Russellville (common); Sallisaw River at Makey's (scarce). All of the species belonging to the genus *Notropis* are known as minnows. Only a few of the larger and better-known ones have received common names.

24. Notropis whipplei (Girard). *Silver-fin.* Arkansas River at Mulberry; Chadron River at Pinnacle Springs; East Fork of Chadron at Conway (common); Cove Creek at Martinsville (abundant); Illinois River at Russellville (common); Mulberry River at Mulberry; Sallisaw River at Makey's (abundant); North Fork of Chadron at Martinsville (common).

25. Notropis lutrensis (Baird & Girard). Arkansas River at Little Rock (common) and at Mulberry (scarce); Mulberry River at Mulberry (scarce).

26. Notropis xænocephalus (Jordan). Mulberry River at Mulberry (scarce), Cove Creek at Martinsville and Illinois River at Russellville (common).

27. Notropis telescopus caddoënsis Meek. Cove Creek at Martinsville (scarce); Illinois River at Russellville; North Fork of Chadron at Martinsville (common).

28. Notropis umbratilis (Girard). Chadron River at Pinnacle Spring and Cove Creek at Martinsville (scarce).

29. Notropis dilectus (Girard). *Emerald Minnow.* Arkansas and Mulberry rivers at Mulberry; Chadron River at Pinnacle Springs; East Fork of Chadron at Conway and Sallisaw River at Makey's store (scarce). The bodies of all of these specimens are deeper than usual.

30. Hybopsis amblops (Rafinesque). *Silver Chub.* Arkansas River at Mulberry (scarce).

31. Hybopsis storerianius (Kirtland). *Hornyhead; River Chub.* Arkansas River at Mulberry and East Fork of Chadron at Conway (scarce).

32. Hybopsis kentuckiensis (Rafinesque). Sallisaw River at Makey's (abundant).

33. Semotilus atromaculatus (Mitchill). *Horned Dace; Creek Chub.* Illinois River at Russellville (scarce).

34. Notemigonus chrysoleucus (Mitchill). *Golden Shiner.* Sallisaw River at Makey's (scarce).

35. Dorosoma cepedianum (Le Sueur). *Gizzard Shad; Hickory Shad.* Arkansas River at Mulberry (common); East Fork of Chadron at Conway (scarce).

36. Clupea chrysochloris (Rafinesque). *Skipjack.* Mulberry River at Mulberry (scarce).

37. Hiodon alosoides (Rafinesque). *Moon-eye.* Arkansas River at Little Rock and Mulberry (common), and Sallisaw River at Makey's (scarce).

38. Zygonectes notatus (Rafinesque). *Top-minnow.* Chadron at Pinnacle Spring (scarce); East Fork of Chadron at Conway, (common); Cove Creek at Martinsville (scarce); Illinois River at Russellville (common); Mulberry River at Mulberry (abundant); Sallisaw River at Makey's (common); North Fork of Chadron at Martinsville (scarce).

39. Gambusia affinis (Baird & Girard). Chadron River at Pinnacle Spring (scarce); East Fork of Chadron at Conway (common). Gravid females were taken the last week in August.

40. Labidesthes sicculus (Cope). *Brook Silverside.* Cove Creek at Martinsville and Illinois River at Russellville (scarce); Mulberry River at Mulberry and Sallisaw River at Makey's (common).

41. Ambloplites rupestris (Rafinesque). *Rock Bass.* Sallisaw River at Makey's (scarce).

42. Chænobryttus gulosus (Cuvier & Valenciennes). *Warmouth; Red-eyed Bream.* Cove Creek at Martinsville (scarce).

43. Pomoxis sparoides (Rafinesque). *Calico Bass; Grass Bass.* Chadron River at Pinnacle Springs (scarce).

44. Lepomis cyanellus (Rafinesque). *Green Sunfish; Perch.* East Fork of Chadron at Conway; Cove Creek at Martinsville; Illinois River at Russellville and Mulberry River at Mulberry (scarce); Sallisaw River at Makey's (common).

45. Lepomis pallidus (Mitchill). *Blue Sunfish; Perch.* Chadron at Pinnacle Spring, Cove Creek at Martinsville, and Illinois River at Russellville (scarce).

46. Lepomis megalotis (Rafinesque). *Long-eared Sunfish; Perch.* The Chadron River at Pinnacle Springs; (scarce); East Fork of Chadron at Conway; Cove Creek at Martinsville; Illinois River at Russellville (common); Mulberrry River at Mulberry; Sallisaw River at Makey's (abundant); North Fork of Chadron at Martinsville (common).

47. Lepomis humilis (Girard). *Red-spotted Sunfish; Perch.* Illinois River at Russellville (scarce); Sallisaw River at Makey's (common).

48. Micropterus salmoides (Lacépède). *Large-mouthed Black Bass; Trout.* Arkansas River at Mulberry (common); Chadron River at Pinnacle Springs and East Fork of Chadron at Conway (scarce); Cove Creek at Martinsville; Illinois River at Russellville and Mulberry River at Mulberry (common); Sallisaw River at Makey's; North Fork of Chadron at Conway (scarce). In the Southern States this and the following species are usually called trout. The true trout are not natives of Arkansas, but a few have been introduced by the U. S. Fish Commission.

49. **Micropterus dolomieu** Lacépède. *Small-mouthed Black Bass; Trout.* Illinois River at Russellville; Mulberry River at Mulberry and Sallisaw River at Makey's (common).
50. **Etheostoma pellucidum vivax** (Hay). *Sand Darter.* East Fork Chadron at Conway (scarce); Illinois River at Russellville (common).
51. **Etheostoma blennioides** (Rafinesque). *Green-sided Darter.* Cove Creek at Martinsville; Illinois River at Russellville and Sallisaw River at Makey's (scarce).
52. **Etheostoma aspro** (Cope & Jordan). *Black-sided Darter.* Chadron River at Pinnacle Springs; East Fork Chadron at Conway; Cove Creek at Martinsville and Sallisaw River at Makey's (scarce).
53. **Etheostoma saxatile** (Hay). East Fork Chadron at Conway and Cove Creek at Martinsville (scarce); Illinois River at Russellville and Sallisaw River at Makey's (common).
54. **Etheostoma zonale** (Cope). Illinois River at Russellville (scarce).
55. **Etheostoma whipplei** (Girard). Illinois River at Russellville (scarce); Sallisaw River at Makey's (common).
56. **Etheostoma chlorosoma** (Hay). East Fork of Chadron River at Conway (scarce). Dorsal spines, 8 to 10.
57. **Etheostoma cœruleum spectabile** (Agassiz). *Rainbow Darter.* Sallisaw River at Makey's (common).
58. **Etheostoma microperca** Jordan & Gilbert. *Least Darter.* Illinois River at Russellville and Sallisaw River at Makey's (scarce).
59. **Stizostedion canadense** (C. H. Smith). *Wall-eyed Pike; Sauger.* Illinois River at Russellville (scarce).
60. **Roccus chrysops** (Rafinesque). *Striped Bass.* Arkansas River at Mulberry (common).
61. **Aplodinotus grunniens** (Rafinesque). *Fresh-water Drum.* Arkansas River at Little Rock and Mulberry (common).

THE ILLINOIS RIVER BASIN.

This river drains a portion of the northern and western slope of the Boston Mountains. It first flows north and then west, into the Indian Territory, thence bending south and emptying into the Arkansas River near Fort Gibson. Its basin lies, for the most part, in a cherty limestone region, and its upper tributaries are well supplied with springs and spring brooks. The Illinois resembles closely the upper White River. It was examined near Prairie Grove and Ladd's Mill, in Washington County, Ark. At both of these localities the stream is a good-sized creek, with rocky and sandy bottom. Clear Creek, an eastern tributary, is a clear stream well fed by springs, Johnson spring being near its source. The Barren Fork and Jordan Creek are also supplied richly by springs, though these are all small. Our collections from Jordan Creek were made near the mouth at Dutch Mills; from Clear Creek, near Johnson.

LIST OF THE FISHES OF THE ILLINOIS RIVER BASIN IN WASHINGTON COUNTY, ARKANSAS.

1. **Ameiurus melas** (Rafinesque). *Bullhead.* Illinois River at Prairie Grove and Ladd's Mill (common).
2. **Catostomus teres** (Mitchill). *Common White Sucker.* Illinois River at Prairie Grove (abundant) and Ladd's Mill (common); Clear Creek at Johnson and Jordan Creek at Dutch Mills (common).
3. **Catostomus nigricans** (Le Sueur). *Hog Sucker; Mullet.* Illinois River at Prairie Grove (common) and Ladd's Mill (scarce).
4. **Noturus exilis** (Nelson). *Stone Cat.* Illinois River at Ladd's Mill (scarce).
5. **Moxostoma duquesnei** (Le Sueur). *Common Redhorse Sucker.* Illinois River at Prairie Grove and Ladd's Mill (scarce); Clear Creek at Johnson and Jordan Creek at Dutch Mills (common).
6. **Campostoma anomalum** (Rafinesque). *Stone-roller; Stone-lugger.* Illinois River at Prairie Grove and Ladd's Mill; Jordan Creek at Dutch Mills; Clear Creek at Johnson (common).

7. **Hybognathus nubila** (Forbes). Illinois River at Prairie Grove and Ladd's Mill and Jordan Creek at Dutch Mills (abundant); Clear Creek at Johnson (scarce).

8. **Pimephales promelas** (Rafinesque). *Fathead Minnow.* Illinois River at Prairie Grove (common).

9. **Pimephales notatus** (Rafinesque). *Blunt-nosed Minnow.* Illinois River at Prairie Grove (abundant) and Ladd's Mill (common); Jordan Creek at Dutch Mills (common).

10. **Notropis shumardi** (Girard). Illinois River at Prairie Grove and Ladd's Mill; Jordan Creek at Dutch Mills; Clear Creek at Johnson (common).

11. **Notropis cornutus.** (Mitchill). *Common Shiner.* Illinois River at Prairie grove (abundant) and Ladd's Mill (scarce).

12. **Notropis zonatus** (Agassiz). Illinois River at Prairie Grove (abundant) and Ladd's Mill (common); Jordan Creek at Dutch Mills (abundant); Clear Creek at Johnson (common).

13. **Notropis dilectus** (Girard). *Emerald Minnow.* Illinois River at Prairie Grove and Ladd's Mill, and Jordan Creek at Dutch Mills (scarce).

14. **Hybopsis amblops** (Rafinesque). Illinois River at Prairie Grove and Ladd's Mill; Clear Creek at Johnson (common).

15. **Hybopsis kentuckiensis** (Rafinesque). *River Chub.* Illinois River at Prairie Grove (scarce) and Ladd's Mill (common); Jordan Creek at Dutch Mills and Clear Creek at Johnson (abundant).

16. **Semotilus atromaculatus** (Mitchill). *Horned Dace; River Chub.* Illinois River at Prairie Grove (common).

17. **Zygonectes notatus** (Rafinesque). *Top-minnow.* Illinois River at Prairie Grove and Ladd's Mill; Clear Creek at Johnson (scarce).

18. **Labidesthes sicculus** (Cope). *Brook Silverside.* Illinois River at Prairie Grove (scarce) and Ladd's Mill (common).

19. **Lepomis cyanellus** (Rafinesque). *Green Sunfish; Perch.* Illinois River at Prairie Grove (common and Ladd's Mill (scarce).

20. **Lepomis macrochirus** (Rafinesque). *Perch.* Illinois River at Prairie Grove (scarce). Scales, 45; dorsal fin, X–11; gill-rakers long, nearly half diameter of eye; last rays of dorsal with a black spot; pectoral fins long, their tips reaching third anal spine; body similar in form to *Lepomis megalotis.* A decided angle in profile between eyes.

21. **Lepomis humilis** (Girard). *Red-spotted Sunfish; Perch.* Illinois River at Prairie Grove (common) and Ladd's Mill (scarce).

22. **Lepomis megalotis** (Rafinesque). *Long-eared Sunfish; Perch.* Illinois River at Prairie Grove and Ladd's Mill, and Jordan Creek at Dutch Mills (abundant); Clear Creek at Johnson (common).

23. **Micropterus salmoides** (Lacépède). *Large-mouthed Black Bass; Trout.* Clear Creek at Johnson (scarce).

24. **Micropterus dolomieu** Lacépède. *Small-mouthed Black Bass; Trout.* Illinois River at Prairie Grove (scarce) and at Ladd's Mill (abundant); Jordan Creek at Dutch Mills (common); Clear Creek at Johnson (scarce).

25. **Etheostoma caprodes** (Rafinesque). *Log Perch; Hogfish.* Illinois River at Prairie Grove and Clear Creek at Ladd's Mill (scarce).

26. **Etheostoma blennioides** (Rafinesque). *Green-sided Darter.* Illinois River at Prairie Grove and Ladd's Mill; Clear Creek at Johnson (scarce).

27. **Etheostoma cœruleum spectabile** (Agassiz). *Rainbow Darter.* Illinois River at Prairie Grove (abundant); Jordan Creek at Dutch Mills (scarce); Clear Creek at Johnson (common).

28. **Etheostoma zonale** (Cope). Illinois River at Prairie Grove (common) and Ladd's Mill (scarce).

29. **Etheostoma flabellare** (Rafinesque). *Striped Darter.* Illinois River at Prairie Grove and Ladd's Mill (scarce).

30. **Etheostoma saxatile** (Hay). Illinois River at Prairie Grove (scarce). D. XII-12; A. 2–9; scales, 51. No distinct black spot at base of caudal.

31. **Cottus bairdi** (Girard). *Miller's Thumb; "Cod."* Illinois River at Prairie Grove and Ladd's Mill (scarce); Clear Creek at Johnson (common).

NOTES ON PREVIOUS INVESTIGATIONS OF THE FISHES OF ARKANSAS, WITH LISTS OF THE SPECIES COLLECTED.

During the explorations and surveys for a railroad route from the Mississippi River to the Pacific Ocean in 1851 to 1858, a few fishes were collected in the State of Arkansas by the surveying party. These specimens were studied by Dr. Charles Girard, whose results were published in the Proceedings of the Academy of Natural Sciences at Philadelphia, from 1856 to 1859, inclusive, and also in volume X of the Pacific Railroad Survey Report, 1858.

In Bulletin U. S. National Museum, 1877, p. 50, Dr. David S. Jordan described two new species of fishes from the Little Red River at Judsonia, Arkansas: *Elassoma zonatum* and *Asternotremia mesotrema* = *Aphredoderus sayanus*.

In 1884, under the auspices of the U. S. National Museum and the U. S. Fish Commission, Dr. David Starr Jordan and Prof. Charles H. Gilbert made a collection of fishes in the same State, at Eureka Springs, Fort Smith, Arkadelphia, Benton, and Fulton. Their report upon this material was printed in the Proceedings of the U. S. National Museum for 1886.

During the latter part of June, 1888, Prof. Charles H. Gilbert, while in the employ of the Arkansas State Geological Survey, obtained a few fishes in a small tributary of the Poteau, 7 miles west of Waldron, in Scott County. The list of these species, published in the Proceedings of the U. S. National Museum for the same year, is as follows:

Campostoma anomalum.	*Lepomis humilis.*
Pimephales notatus.	*Lepomis megalotis.*
Notropis heterodon.	*Etheostoma cæruleum lepidum.*
Notropis umbratilis.	*Etheostoma whipplei.*
Zygonectes notatus.	*Etheostoma microperca.*

The writer, also, in June, 1888, being then in the service of the State Geological Survey, collected a small number of fishes in Spadra Creek, near Clarksville, Johnson County. In July and August of the following year he spent six weeks in exploring the streams of the Ozark region in western Arkansas and southern Missouri, in the interests of the U. S. Fish Commission, and with the assistance of Mr. Louis Rettger and Mr. Frank M. Drew, then students in the Indiana University, a large collection of fishes was obtained. The results of the investigation were published in the Bulletin of the U. S. Fish Commission, vol. IX, for 1889, pp. 113-141.

The following three tables, giving lists of the fishes reported upon by Drs. Girard, Jordan, and Gilbert, and the writer, as above indicated, have been arranged to show also the different places at which the several species were collected on each of the expeditions to which they relate.

List of fishes collected in Arkansas during the survey for a railroad route from the Mississippi to the Pacific Ocean, and reported upon by Dr. Charles Girard.

Place of publication. Proc. Acad. Nat. Sci. Phila. 1856.	Proc. Acad. Nat. Sci. Phila. 1858.	Pac. R. R. survey rep., vol. X. 1858.	Girard's names.	Names used at present.	Localities where obtained. Ft. Smith.	Arkansas River, near Ft. Smith.	Near mouth of Poteau River.	Coal Creek.	Otter Creek, tributary of the Red River.	Sugar Loaf Creek.	Antelope Creek.	Fort Wichita, Red River.	Sluice of Arkansas River, near Fort McKee.
Page.	*Page.*	*Page.*											
		35	Ichthyomyzon hirudo	Petromyzon concolor	×								
		357	Scaphyrhynchus platyrhynchus.	Scaphirhynchus platyrhynchus.			×						
		211	Pimelodus olivaceus	Ictalurus punctatus		×							
		209	Pimelodus felinus	Ameiurus natalis				×					
		208	Pimelodus catulus	Ameiurus melas									
170			Carpiodes damalis	Ictiobus velifer	×								
		229	Dionda spadicea	Zophendum plumbeum	×								
		236	Hybognathus placita	Hybognathus nuchalis									
182			Hybognathus argyritus	Hybognathus argyritus	×								
180		234	Pimephales maculosus	Pimephales promelas				×					
179		231	Hyborhynchus perspicuus	Pimephales notatus		×							
192		257	Cliola vigilax	Cliola vigilax					×				
194		262	Alburnops illecebrosus	Notropis blennius	×								
194		261	Alburnops shumardi	Notropis shumardi	×								
194			Alburnops blennius	Notropis blennius	×								
197		265	Cyprinella bubalinus	Notropis bubalinus					×				
		266	Cyprinella umbrosa	do				×					
197		267	Cyprinella beckwithi	do									×
199		272	Moniana lutrensis	Notropis lutrensis					×				
200		275	Moniana pulchella	do		×				×			
198		270	Cyprinella whipplei	Notropis whipplei						×			
193		260	Alburnus umbratilis	Notropis umbratilis						×			
193		259	Alburnellus dilectus	Notropis dilectus		×							
191		256	Exoglossum mirabile	Phenacobius mirabilis									
189		249	Gobio vernalis	Hybopsis storerianus		×							
190		256	Leucosomus pallidus	Semotilus atromaculatus							×		
	200	14	Calliurus formulosus	Lepomis cyanellus								×	
		16	Calliurus longulus	do					×				
		17	Calliurus microps	do									
		28	Pomotus breviceps	Lepomis megalotis	×				×			×	
	201	21	Bryttus humilis	Lepomis humilis						×			
		5	Dioplites nuecensis	Micropterus salmoides				×					
		96	Amblodon grunniens	Aplodinotus grunniens			×						
	103		Boleichthys whipplei	Etheostoma whipplei				×					

List of fishes collected in Arkansas, in 1884, by Dr. D. S. Jordan and Prof. C. H. Gilbert, and reported upon by them in Proc. U. S. Nat. Mus. for 1886.

Names of the species.	Localities where obtained.			
	Eureka Springs.	Fort Smith.	Arkadelphia.	Fulton.
Scaphirhynchus platyrhynchus				×
Lepisosteus osseus		×		×
Lepisosteus tristœchus		×		
Ictalurus punctatus		×	×	×
Ameiurus natalis		×		
Leptops olivaris		×		×
Noturus flavus		×		
Noturus nocturnus		×	×	
Noturus miurus	×	×	×	
Ictiobus bubalus				×
Carpiodes velifer		×	×	×
Catostomus nigricans		×	×	
Moxostoma duquesnei	×	×	×	
Placopharynx carinatus	×	×	×	
Lagochila lacera	×			
Campostoma anomalum	×	×	×	
Hybognathus nuchalis		×	×	×
Hybognathus nubila	×			
Pimephales notatus	×	×		
Cliola vigilax		×		
Notropis blennius		×		
Notropis shumardi	×	×	×	
Notropis telescopus arcansanus	×			
Notropis galacturus	×			
Notropis venustus				×
Notropis lutrensis		×		
Notropis whipplei		×		
Notropis zonatus	×			
Notropis megalops	×			
Notropis umbratilis		×		
Notropis dilectus		×	×	×
Notropis micropteryx	×			
Phenacobius mirabilis		×		
Hybopsis dissimilis	×		×	
Hybopsis watauga	×			
Hybopsis æstivalis		×		×
Hybopsis amblops	×	×		
Hybopsis storerianus		×		×
Hybopsis kentuckiensis	×			
Phoxinus neogæus	×			
Hiodon alosoides				×
Hiodon tergisus			×	
Clupea chrysochloris			×	×
Dorosoma cepedianum		×	×	×
Fundulus catenatus	×		×	
Zygonectes notatus	×	×	×	×
Gambusia affinis		×	×	×
Lucius vermiculatus			×	
Labidesthes sicculus	×	×	×	
Pomoxis sparoides				×
Pomoxis annularis		×		
Lepomis cyanellus		×	×	
Lepomis pallidus		×	×	×
Lepomis megalotis	×	×	×	
Lepomis humilis	×	×	×	
Micropterus salmoides	×	×	×	×
Micropterus dolomieu			×	
Etheostoma clarum				×
Etheostoma vivax		×	×	
Etheostoma asprellum			×	
Etheostoma histrio		×	×	
Etheostoma uranidea			×	
Etheostoma shumardi		×	×	×
Etheostoma blennioides	×	×		
Etheostoma caprodes	×	×	×	
Etheostoma copelandi		×	×	
Etheostoma phoxocephalum		×		
Etheostoma aspro		×	×	
Etheostoma ouachitæ			×	
Etheostoma camurum		×	×	
Etheostoma evides	×			
Etheostoma scierum			×	
Etheostoma zonale arcansanum	×		×	
Etheostoma saxatile			×	
Etheostoma whipplei		×		
Etheostoma spectabile	×		×	
Etheostoma fusiforme		×	×	
Etheostoma fonticola			×	
Stizostedion canadense		×		
Stizostedion vitreum				
Roccus chrysops			×	×
Aplodinotus grunniens		×		×
Cottus richardsoni	×			

List of fishes collected in Arkansas in 1888 and 1889, by Seth E. Meek, and reported upon by him in Bulletin U. S. Fish Commission for 1889, pp. 113–141.

Names of the species.	Localities where obtained.												
	Ouachita River, Crystal Springs, Ark.	Caddo River, Caddo Gappe and Black Spring.	West Ouachita River, Mount Ida, Ark.	Mazarn Creek, Myers, Ark.	Myers Creek, Myers, Ark.	West Fork Saline River, Hot Springs, Ark.	Little Red River, Judsonia, Ark.	Spring Creek, Mammoth Springs.	Spring River, Mammoth Springs.	Warm Fork Spring River, Mammoth Spring.	English Creek, Mammoth Springs.	Myatt Creek, Mammoth Spring.	Spadra Creek.
Ictalurus punctatus													×
Ameiurus melas												×	
Ameiurus nebulosus									×		×		
Noturus nocturnus	×					×							
Ictiobus velifer													×
Catostomus teres													
Catostomus nigricans	×	×	×	×	×	×			×		×	×	
Erimyzon sucetta	×			×			×		×				×
Moxostoma duquesnei	×		×	×	×	×			×			×	×
Campostoma anomalum	×	×	×	×	×	×			×				×
Chrosomus erythrogaster			×					×					
Pimephales notatus	×	×	×	×	×	×				×		×	×
Hybognathus nuchalis							×		×		×	×	
Hybognathus nubila						×							
Notropis boops	×	×	×	×	×	×							×
Notropis galacturus									×		×	×	
Notropis lutrensis										×			
Notropis whipplei	×	×	×		×	×	×						×
Notropis megalops							×		×		×	×	
Notropis zonatus									×			×	
Notropis umbratilis	×	×	×	×	×	×			×				
Notropis dilectus (rubrifrons)													
Notropis telescopus arcansanus													
Notropis atherinoides caddoënsis		×					×						
Hybopsis dissimilis	×												
Hybopsis amblops													
Hybopsis kentuckiensis												×	
Semotilus atromaculatus		×					×	×					
Notemigonus chrysoleucus													
Salmo irideus									×				
Dorosoma cepedianum													×
Fundulus catenatus	×	×	×	×								×	
Zygonectes macdonaldi													
Zygonectes notatus		×	×	×		×	×				×	×	×
Lucius vermiculatus			×	×					×			×	
Lucius reticulatus							×		×		×		
Labidesthes sicculus	×	×	×	×	×	×	×					×	×
Aphredoderus sayanus	×						×						
Elassoma zonatum							×						
Ambloplites rupestris			×										
Chænobryttus gulosus	×						×					×	
Lepomis cyanellus	×	×	×	×	×		×		×		×	×	
Lepomis garmani									×				
Lepomis pallidus		×							×		×		
Lepomis megalotis	×	×	×	×	×	×			×		×	×	×
Lepomis humilis													×
Micropterus salmoides		×							×		×		
Micropterus dolomieu	×	×	×	×	×	×			×				
Etheostoma nigrum													
Etheostoma blennioides	×	×	×	×	×		×		×		×	×	×
Etheostoma caprodes	×												×
Etheostoma copelandi	×												
Etheostoma phoxocephalum	×												
Etheostoma zonale	×	×	×			×	×		×				
Etheostoma whipplei	×	×	×	×	×	×							
Etheostoma cœruleum									×				
Etheostoma cœruleum spectabile								×	×		×	×	
Etheostoma stigmæum	×	×	×										
Etheostoma fusiforme							×						
Etheostoma chlorosoma	×												
Etheostoma microperca													
Aplodinotus grunniens													×
Cottus richardsoni									×				

GEOGRAPHICAL DISTRIBUTION OF THE FISHES OF ARKANSAS.

The following table includes a list of the fishes so far found in Arkansas and their distribution in the principal river basins:

[*g* listed by Dr. Girard; *j* listed by Drs. Jordan and Gilbert; *m* listed by the writer.]

No.	Names.	White River basin.	Black River basin.	Little Red River basin.	Arkansas River basin.	Illinois River basin.	Ouachita River basin.	Red River basin.
	Family Petromyzontidæ:							
1	Petromyzon concolor				*g, m*			
	Family Polyodontidæ:							
2	Polyodon spathula	*m*						*j*
	Family Acipenseridæ:							
3	Scaphirhynchus platyrhynchus				*g*			
	Family Lepisosteidæ:							
4	Lepidosteus osseus	*m*	*m*	*m*	*j, m*			*j*
5	Lepidosteus platystomus			*m*				
6	Lepidosteus tristœchus				*j m*			
	Family Amiidæ:							
7	Amia calva			*m*				
	Family Siluridæ:							
8	Ictalurus punctatus	*j, m*	*m*	*m*	*g, j, m*		*j*	*j*
9	Ictalurus furcatus							
10	Ameiurus nigricans	*m*						
11	Ameiurus natalis				*j, g*			
12	Ameiurus nebulosus	*m*	*m*	*m*				
13	Ameiurus melas	*m*	*m*	*m*	*g, m*	*m*		
14	Leptops olivaris				*j, m*			*j*
15	Noturus flavus				*j*			
16	Noturus miurus	*j, m*			*j*		*j*	
17	Noturus nocturnus		*m*		*j*		*j, m*	
18	Noturus eleutherus	*m*			*m*			
19	Noturus gyrinus					*m*		
20	Noturus exilis	*m*				*m*		
	Family Catostomidæ:							
21	Ictiobus bubalus		*m*					*j*
22	Ictiobus urus	*m*			*m*			
23	Carpiodes velifer			*m*	*j, g, m*		*j*	*j*
24	Cycleptus elongatus		*m*					
25	Catostomus teres		*m*			*m*		
26	Catostomus nigricans	*m*	*m*		*j, m*	*m*	*j, m*	
27	Erimyzon sucetta	*m*	*m*	*m*	*m*		*m*	
28	Minytrema melanops	*m*		*m*	*m*			
29	Moxostoma duquesnei	*j, m*	*m*	*m*	*j m*	*m*	*j, m*	
30	Placopharynx carinatus	*j*	*m*	*m*	*j, m*		*j*	
31	Lagochila lacera	*j*						
	Family Cyprinidæ:							
32	Campostoma anomalum	*j, m*	*m*	*m*	*j, m*	*m*	*j, m*	
33	Chrosomus erythrogaster	*m*	*m*				*m*	
34	Hybognathus nuchalis	*m*	*m*	*m*	*j, g, m*		*j*	*j*
35	Hybognathus argyritis				*g*			
36	Hybognathus nubila	*j, m*			*m*	*m*	*m*	
37	Zophendum plumbeum				*g*			
38	Pimephales promelas			*m*	*g, m*	*m*		
39	Pimephales notatus	*j, m*	*m*	*m*	*g, j, m*	*m*	*m*	
40	Cliola vigilax	*m*	*m*		*m*			*g*
41	Notropis heterodon			*m*	*j*			
42	Notropis illecebrosus				*j, g*			
43	Notropis blennius		*m*		*g, m*			
44	Notropis ozarcanus	*m*	*m*					
45	Notropis shumardi	*j, m*	*m*	*m*	*j, m*	*m*	*j*	
46	Notropis xænocephalus	*m*	*m*	*m*	*m*			
47	Notropis whipplei	*m*	*m*	*m*	*j, m*		*m*	
48	Notropis galacturus	*m*	*m*	*m*				
49	Notropis venustus	*m*	*m*	*m*				*j*
50	Notropis lutrensis		*m*		*j, g, m*			*g*
51	Notropis bubalinus				*g*			
52	Notropis cornutus	*j, m*	*m*	*m*	*m*	*m*		
53	Notropis zonatus	*j, m*	*m*			*m*		
54	Notropis umbratilis	*m*	*m*	*m*	*j, g, m*		*m*	
55	Notropis dilectus	*m*	*m*	*m*	*j, g, m*	*m*	*j*	*j*
56	Notropis telescopus arcansus	*m*	*m*					
57	Notropis atherinoides caddoënsis	*m*	*m*	*m*	*m*		*m*	
58	Notropis micropteryx	*j*						
59	Phenacobius mirabilis				*j, g*			
60	Hybopsis amblops	*j, m*	*m*		*j, m*	*m*		
61	Hybopsis dissimilis	*j, m*					*j, m*	
62	Hybopsis watauga	*j*		*m*				
63	Hybopsis æstivalis				*j*		*j*	
64	Hybopsis storerianus			*m*	*j, g, m*		*j*	
65	Hybopsis kentuckiensis	*j, m*	*m*		*m*	*m*		
66	Phoxinus neogæus	*j*						
67	Opsopœodus emiliæ	*m*						

Geographical distribution of the fishes of Arkansas.

No.	Names.	White River basin.	Black River basin.	Little Red River basin.	Arkansas River basin.	Illinois River basin.	Ouachita River basin.	Red River basin.
	Family Cyprinidæ—Continued.							
68	Semotilus atromaculatus	*m*	*m*	*m*	*m, g*	*m*	*m*	....
69	Notemigonus chrysoleucus	*m*	....	*m*	*m*	....	....	....
	Family Salmonidæ							
70	Salmo irideus	....	*m*	....	....	....	....	....
	Family Hiodontidæ							
71	Hiodon alosoides	....	....	....	*m*	....	....	*j*
72	Hiodon tergisus	....	....	....	....	....	*j*	....
	Family Clupeidæ:							
73	Clupea chrysochloris	*m*	....	*m*	*m*	....	*j*	*j*
	Family Dorosomatidæ:							
74	Dorosoma cepedianum	*m*	*m*	*m*	*j, m*	....	*j*	*j*
	Family Cyprinodontidæ:							
75	Fundulus catenatus	*j, m*	*m*	....	....	....	*j, m*	....
76	Zygonectes notatus	*j, m*	*m*	*m*	*j, m*	*m*	*j, m*	*j*
77	Gambusia affinis	*m*	*m*	....	*j, m*	....	*j*	*j*
	Family Luciidæ:							
78	Lucius vermiculatus	*m*	*m*	*m*	....	....	*j, m*	....
79	Lucius reticulatus	*m*	*m*	*m*	....	....	....	....
	Family Anguillidæ:							
80	Anguilla chrysypa	*m*	*m*	....	....	....	....	....
	Family Atherinidæ:							
81	Labidesthes sicculus	*j, m*	*m*	*m*	*j, m*	*m*	*j, m*	....
	Family Aphredoderidæ:							
82	Aphredoderus sayanus	*m*	*m*	*j, m*	....	....	....	....
	Family Elassomatidæ:							
83	Elassoma zonatum	*m*	....	*j, m*	....	....	....	....
	Family Centrarchidæ:							
84	Centrarchus macropterus	....	....	*m*	....	....	....	....
85	Pomoxis sparoides	....	*m*	*m*	*m*	....	....	*j*
86	Pomoxis annularis	....	....	....	*j*	....	....	....
87	Ambloplites rupestris	*m*	*m*	*m*	*m*	....	*m*	....
88	Chænobryttus gulosus	....	*m*	*m*	*m*	....	*m*	....
89	Lepomis cyanellus	*m*	*m*	*m*	*j, g, m*	*m*	*j, m*	*g*
90	Lepomis macrochirus	*m*	*m*	*m*	....	*m*	....	....
91	Lepomis megalotis	*j, m*	*m*	*m*	*j, g, m*	*m*	*j, m*	*g*
92	Lepomis garmani	*m*	*m*	....	....	....	....	....
93	Lepomis pallidus	*m*	*m*	....	*j, m*	....	*j, m*	*j*
94	Lepomis humilis	*j*	....	*m*	*j, g, m*	*m*	*j*	....
95	Micropterus salmoides	*j, m*	*m*	*m*'	*j, g, m*	*m*	*j, m*	*j*
96	Micropterus dolomieu	*m*	*m*	*m*	*m*	*m*	*j, m*	....
	Family Percidae:							
97	Etheostoma pellucidum vivax	*m*	*m*	*m*	*j, m*	....	*j*	....
98	Etheostoma pellucidum clarum	....	....	....	....	....	....	*j*
99	Etheostoma asprellum	....	....	....	....	....	*j*	....
100	Etheostoma nigrum	*m*	*m*	....	....	....	....	....
101	Etheostoma chlorosoma	....	*m*	....	*m*	....	*m*	....
102	Etheostoma histrio	....	*m*	....	*j*	....	*j*	....
103	Etheostoma uranidea	*m*	*m*	....	....	....	*j*	....
104	Etheostoma juliæ	*m*	....	....	....	....	....	....
105	Etheostoma shumardi	....	....	....	*j*	....	*j*	*j*
106	Etheostoma blennioides	*j, m*	*m*	*m*	*j, m*	*m*	*m*	....
107	Etheostoma caprodes	*j, m*	*m*	....	*j, m*	*m*	*j, m*	....
108	Etheostoma copelandi	....	....	*m*	*j*	....	*j, m*	....
109	Etheostoma phoxcephalum	....	....	*m*	*j*	....	*m*	....
110	Etheostoma aspro	*m*	*m*	*m*	*j, m*	....	*j*	....
111	Etheostoma ouachitæ	*m*	....	....	....	....	*j*	....
112	Etheostoma camurum	....	....	....	*j*	....	*j*	....
113	Etheostoma evides	*j*	*m*	....	....	....	....	....
114	Etheostoma cymatotænia	*m*	....	....	....	....	....	....
115	Etheostoma scierus	....	....	....	....	....	*j*	....
116	Etheostoma zonale	*j, m*	*m*	*m*	*m*	*m*	*j, m*	....
117	Etheostoma flabellare	....	....	....	....	*m*	....	....
118	Etheostoma stigmæum	*m*	*m*	....	*m*	*m*	*j, m*	....
119	Etheostoma punctulatum	*m*	....	....	....	....	....	....
120	Etheostoma whipplei	*m*	*m*	*m*	*j, g, m*	....	*m*	....
121	Etheostoma cœruleum spectabile	*j, m*	*m*	*m*	*m*	*m*	*j*	....
122	Etheostoma cœruleum lepidum	*m*	....	....	*j*	....	....	....
123	Etheostoma jessiæ	*m*	....	....	....	....	....	....
124	Etheostoma iowæ	*m*	....	....	....	....	....	....
125	Etheostoma fusiforme	....	....	*m*	*j*	....	*j*	....
126	Etheostoma fonticola	....	....	....	....	....	*j*	....
127	Etheostoma microperca	....	....	*m*	*j*	....	....	....
128	Stizostedion canadense	....	....	....	*j, m*	....	....	....
129	Stizostedion vitreum	....	....	....	*j*	....	....	....
	Family Serranidæ:							
130	Roccus chrysops	*m*	....	....	*m*	....	*j*	*j*
	Family Sciænidæ:							
131	Aplodinotus grunniens	....	....	*m*	*j, g, m*	....	....	*j*
	Family Cottidæ:							
132	Cottus bairdi	*j, m*	*m*	....	....	*m*	....	....
		82	68	59	84	32	59	25

APPENDIX.

The following list comprises two small collections of fishes from the Indian Territory; one collection was made in the last week of May, 1893, from a small creek tributary to a southern affluent of the Canadian River at McAlester; the other from a lake and adjoining ponds near the Poteau River, Poteau.

The creek at McAlester is very small, has a rocky to muddy bottom, and becomes nearly dry in the summer.

The lake near Poteau is from a few rods to one-fourth of a mile in width, and about 2 miles in length, with a depth of over 30 feet. It is connected with the river, which is about one-fourth of a mile distant, in times of high water. The lake is also connected during the year with some ponds near by made by the Frisco Railroad when grading their roadbed. The collection was made from the east end of the lake and from these ponds.

This lake seems to be quite a favorite resort for anglers in the neighboring country. The large-mouthed black bass, the crappie, and the common sunfishes are the more important fishes found; large catfishes, buffalo, and gars are reported as quite common.

The water in the Poteau River was too deep and too full of snags to permit collecting in it.

Ameiurus melas (Rafinesque). *Bullhead.* Abundant in both places.

Campostoma anomalum (Rafinesque). Poteau, scarce.

Minytrema melanops (Rafinesque.) McAlester, 1 specimen.

Hybognathus nuchalis Agassiz. Poteau, scarce.

Pimephales notatus (Rafinesque). Scarce in both localities.

Notropis lutrensis (Baird & Girard). McAlester, scarce.

Notropis umbratilis (Girard). McAlester, common. Specimens very variable in color and form.

Notropis dilectus (Girard). Poteau, scarce.

Hybopsis amblops (Rafinesque). McAlester, scarce.

Opsopœodus emiliæ Hay. McAlester, common. Color of males plain olivaceous, a faint dark lateral band. Anterior and posterior rays of dorsal fin with a conspicuous black blotch. The females are lighter in color and have a more conspicuous lateral band. Sides with a few dark spots forming irregular lateral stripes. Blotches on dorsal fin very faint or none. These specimens were taken the last week in May, which is about their breeding season.

Notemigonus chrysoleucus (Mitchill). McAlester, scarce.

Gambusia affinis (Baird & Girard). Poteau, scarce.

Zygonectes notatus (Rafinesque). McAlester, scarce.

Zygonectes escambiæ Bollman. Poteau, scarce. Scales 32, 9 in transverse row; dorsal rays, 8; anal, 8; head, $3\frac{4}{5}$ in length of body; depth, $4\frac{1}{3}$. Teeth weak, outer series the larger; eye large, its diameter $2\frac{1}{2}$ in length of head, interorbital area flat or slightly concave. Color similar to *Fundulus catenatus*, irregularly spotted except on lower and posterior portion of the body, where the spots form irregular lateral bands.

Labidesthes sicculus Cope. McAlester, scarce; Poteau, abundant.

Pomoxis annularis Rafinesque. Poteau, abundant.

Lepomis cyanellus Rafinesque. Poteau, common.

Lepomis humilis (Girard). Common in both localities.

Lepomis megalotis (Rafinesque). Common in both localities.

Micropterus salmoides (Lacépède). *Large-mouthed Black Bass.* McAlester, common; several specimens 18 inches in length taken one afternoon on a trot line.

Etheostoma nigrum (Rafinesque). McAlester, scarce.

Etheostoma whipplei (Girard). McAlester, scarce.

ARKANSAS INDUSTRIAL UNIVERSITY,
Fayetteville, Ark., February, 1894.

10.—NOTES ON THE CAPTURE OF ATLANTIC SALMON AT SEA AND IN THE COAST WATERS OF THE EASTERN STATES.

By HUGH M. SMITH, M. D.,

Assistant in charge of Division of Statistics and Methods of the Fisheries.

In carrying out its most important function—the maintenance and increase of the supply of food-fishes—the U. S. Commission of Fish and Fisheries, in addition to direct efforts to increase the abundance of fishes naturally inhabiting our various rivers, lakes, and coast waters, has given considerable attention to the experimental introduction of fishes into regions or streams to which they were not native. The wonderful success which has followed the planting of shad and striped bass fry in the waters of the Pacific coast is well known. The results attending the recent attempts of the Commission to establish a run of salmon (*Salmo salar*) in some of the large rivers of the Atlantic coast have been so noteworthy in the case of the Hudson as to afford reasonable ground for expecting the early inauguration of a regular fishery, should the present rate of increase in the abundance of the fish be maintained. Similar striking results may also be anticipated in all the more northern streams of the east coast, including the Housatonic, Connecticut, and Merrimac, in which salmon were at one time found in abundance and are now taken in small numbers, if the ascent of the adult fish to the headwaters for the purpose of spawning is permitted and if sufficiently extensive fish-cultural operations are continued.

The primary purpose of this paper is to record some of the apparent results of salmon propagation in our rivers as shown by the occurrence of the fish at points on the coast or at sea more or less remote from the places where fry have been deposited. While an interesting and instructive compilation might be made of the instances of the capture of salmon in the Hudson, Delaware, Susquehanna, Potomac, and other rivers in which the fish has been acclimated, such a work is not necessary in view of the notice which has already been accorded the matter in the public press and in the reports of several of the State fish commissions, notably the New York commission.

So much yet remains to be learned regarding the lines of migration of the salmon to and from the rivers, its winter habitat, the existence of an "instinct of nativity" which is supposed to impel the return of the fish to the place where hatched, the extent of the coastwise distribution of salmon originally belonging in a given river, and numerous other practical and scientific questions, that the presentation of any data bearing on the occurrence of the fish outside of the rivers may be regarded as acceptable and timely.

In an interesting article on "Salmon at Sea," communicated to the issue of Forest and Stream for February 18, 1892, Mr. A. N. Cheney, the well-known angling expert and writer on fish-cultural matters, discusses the question of the whereabouts of salmon

after they leave the rivers, and quotes the following from a previous contribution by himself on the subject:

> There is a certain mystery about the habits and movements of the sea salmon, after it has left the fresh-water rivers in which it spawns and gone down to the sea, that never has been satisfactorily explained. One theory is that all the salmon of the rivers along a coast may journey down to the sea, and then move ultimately in one great body southward along the coast until they find water of suitable temperature, with an abundance of food, in which to spend their time in growing fat until the spawning instinct warns them to return, when they proceed northward, each river school entering its own particular river as the main school arrives opposite the river mouth. Another theory is that the salmon of each river, as they arrive at its mouth after descending from its headwaters, go out to sea sufficiently far to find the conditions of temperature and food which suit them, and there they remain, separate from the salmon of other rivers, until it is time for them to return to fresh water. Considering the certainty with which the salmon of any particular river return again to the stream of their birth, the latter theory seems the more tenable of the two.

Another object of this paper is to solicit correspondence from fishermen, especially those engaged in the coast and offshore fisheries, concerning the circumstances of the capture of salmon in their nets, and to bring to their attention the opportunity they will thus have of increasing the knowledge of the movements of the salmon, of aiding in the determination of the results of fish-cultural operations, and of ultimately if not immediately benefiting themselves by supplying information that will conduce to the most effective application of artificial methods. To this end it is the intention to send the paper to fishermen engaged in the mackerel, menhaden, and other sea fisheries, and to operators of pound nets, traps, and other shore appliances, with the hope that instances of the capture of salmon may be communicated to this Commission and notes on the size, condition, movements, etc., of the fish be furnished.

To aid in the identification of the salmon when caught by fishermen who have not previously met with the fish, a figure is presented.

In this connection mention may be made of the chinook or quinnat salmon of the Pacific coast (*Oncorhynchus chouicha*), fry of which have been extensively planted in eastern waters by the U. S. Commission of Fish and Fisheries. Up to and including the year 1880, about 12,000,000 fry were deposited in rivers and other waters tributary to the Atlantic. While a few relatively large examples have been taken, this office has no information to show that the attempts to acclimate this species on the Atlantic coast have as yet been successful. In 1891 a few thousand yearling salmon were placed in New York waters tributary to the sea. The possibility of the survival and growth of some of these and of the large early colonies prompts this reference to the matter and suggests the publication of the accompanying figure of the species, to afford a basis for distinguishing the two kinds of salmon, which closely resemble each other. To further aid in the identification of the two species the following key has been prepared:

Rays in anal fin, 9; scales between gill opening and base of tail, 120; branchiostegals (false gill openings), 11 .... ATLANTIC SALMON.

Rays in anal fin, 16; scales between gill opening and base of tail, 150; branchiostegals, 15 to 19 .... PACIFIC SALMON.

Numerous instances might be cited of the taking of salmon in the waters of the Atlantic coast in recent years. Their occurrence in the traps and pound nets is in fact so common that it would hardly be entitled to notice at this time were it not for the circumstance that in regions in which salmon were already known there has been a decided increase in the number observed outside the rivers, and that the fish is now being taken in localities in which it was not previously found.

Instances of the capture of salmon in the coast waters of Maine are naturally numerous, and without significance so far as the purposes of the present paper are concerned. The existence of two important salmon rivers, the Kennebec and the Penobscot, affords an easy explanation of the presence of salmon on the shores on either side of the mouths of those streams. In the report of the U. S. Commission of Fish and Fisheries for 1872–73 Mr. Charles G. Atkins, now superintendent of the salmon-rearing establishment at East Orland, Me., and an authoritative writer on the Atlantic salmon, contributes some notes on its occurrence in the sea adjacent to Penobscot Bay and at Richmond Island, near Portland. These cases, however, have little bearing on the subject in hand, as Mr. Atkins suggests in a recent letter.

A special inquiry, personally conducted on Matinicus, Monhegan, and other islands lying far off the Maine coast, and special researches there made with appropriate apparatus, would doubtless disclose many interesting facts regarding the salmon of a practical and scientific nature. A few apparently unrecorded notes concerning the fish among islands off the island of Mount Desert may be given, which are probably indicative of what may be expected in other sections.

Mr. W. I. Mayo, who has fished herring brush-weirs at the Cranberry Isles for many years, and is a life-long fisherman in that section, communicates the intelligence that salmon were first observed about those islands in 1888. On June 17 a salmon, weighing 20 pounds, was taken in a herring weir, and on June 19 another, weighing 19 pounds, was caught. On July 14 of the same year 6 salmon, weighing 4 to 6 pounds apiece, were secured, but were liberated on account of their size. During the four years intervening between 1888 and 1893 none was taken around these islands, but in June of the latter year they reappeared. On June 11 a salmon weighing 15 pounds was taken in a weir, and on various occasions during that month a number weighing 12 to 15 pounds each were caught by boat fishermen on trawl lines fished for cod. The trawls were baited with herring and set on the bottom in rather deep water. Mr. Mayo states that these were the first salmon ever taken on trawl lines in that region. The Cranberry Isles lie off the southeastern part of Mount Desert Island, and are about 25 miles east from Penobscot Bay and about 35 miles in a straight line from the mouth of the Penobscot River.

On the Massachusetts coast salmon are now regularly taken each year at most of the important pound-net and trap fisheries. The largest numbers are caught in Cape Cod Bay. A State law prohibits the taking of salmon in nets and requires the return to the water alive of all fish so caught. This makes the fishermen diffident about giving information and renders difficult the determination of the abundance of the fish.

On June 6, 1879, the Cape Ann Advertiser, of Gloucester, contained the following note:

> A 10-pound salmon was taken from a weir off Magnolia Thursday night. This is the first salmon caught off Cape Ann for over thirty years. On Saturday morning three more large salmon were taken. The fishermen are highly elated at the prospect of salmon-catching.

During the past five or six years a few salmon have been taken almost every season in the vicinity of Gloucester, the average annual catch being 4 to 6 fish. In 1888 the State fish commissioners reported the capture of 18 salmon in traps at Manchester and Gloucester. In 1893, 13 traps in the neighborhood of Gloucester took 5 salmon.

In December, 1891, a salmon weighing 28 pounds was caught on a cod trawl line set near Halfway Rock, off Salem Harbor, Mass.; Mr. William Dennett, of Gloucester, who secured the fish, reports that he sold it for $46. Mr. Samuel Wiley, of Gloucester, in September, 1893, caught a salmon at sea off Gloucester on a trawl line fished for hake. These are the only instances that have been reported of the capture of salmon on a hook in the vicinity of Gloucester. As the trawl lines in question were set on the bottom at a depth of 20 or 25 fathoms, the fact that these two fish at least were swimming on the bottom may be considered established.

Relatively large numbers of salmon have recently been taken in the pound nets of Cape Cod Bay. Capt. Atkins Hughes, of North Truro, one of the best-informed and most reliable fishermen in the region, informs us that at North Truro, the principal pound-net center in the bay, about 70 large salmon have been annually caught for two or three years. The fish are taken throughout the entire pound-net season, but are most common in the early part of the fishing year (May and June). Some fish weighing 25 to 28 pounds have recently been caught. For two or three years he has noticed in the pound nets in October large numbers of young salmon, about 6 inches long; each net probably takes one or two barrels of these annually; he had never observed these small fish before in his long fishing career in that region. In 1893, however, rather less than the usual number of large salmon were observed, and very few of the small fish mentioned were taken.

Mr. Vinal N. Edwards, of the Fish Commission station at Woods Holl, Mass., states that in September, 1892, when he visited the Cape Cod region, a great many salmon were being taken in the pound nets. They weighed 4 or 5 pounds apiece. At one pound-net fishery in Provincetown he saw enough salmon to fill two sugar barrels.

Concerning the occurrence of salmon in the Cape Cod region, Mr. Cheney, in the article previously mentioned, quotes Hon. Eugene G. Blackford, of New York, as follows:

> We get every winter a few fish from the Atlantic coast that are evidently part of the schools of fish that run up into the Kennebec, Penobscot, and other eastern rivers. During November and December we had about 15 to 20 fish, weighing from 12 to 24 pounds each, that were caught in the mackerel nets in the vicinity of Provincetown and North Truro, Mass. These nets are set out from the Cape in very deep water. During the past two or three weeks we have received several specimens of very handsome salmon from Maine, where they have been caught by the smelt fishermen in their nets when they have been fishing for smelt. I think these catches of salmon go very far to prove that the schools of fish are not very far off from our shores during the time that they are not found in the rivers, and that both shad and salmon, when they leave our rivers, do not go either east or south, but are within 100 miles or so of the rivers where they were spawned. The fish are remarkable in being in splendid condition and perfect in form and appearance.

Mr. Cheney thinks the salmon taken off Cape Cod belong in either the Merrimac River or the Penobscot River; and, as in the year in question fish were being caught at the mouth of the Penobscot at the same time they were being taken at Cape Cod, he thinks it probable that the fish in the latter region were from the Merrimac.

In the pound-net fishery of the northern coast of New Jersey the recent capture of salmon has been a subject of much interest to the local fishermen and of considerable importance to fish-culturists and naturalists.

For a number of years a few salmon have, from time to time, been taken in Sandy Hook Bay, but within the past two or three years there has been an increase in the number caught. At Belford, the principal fishing center in the bay, Mr. M. C. Lohsen states that some have been taken weighing from 12 to 40 pounds, and that in

the spring of 1893 more than the usual number were caught in the pound nets. Mr. Harry White, of the same place, never took salmon in pound nets prior to 1891; he secured 1 that year and 2 in 1892, but failed to get any in 1893. Other fishermen, however, obtained one or two fish. The average weight of the salmon taken here is 12 to 15 pounds; the largest caught by Mr. White weighed 17½ pounds. Small ones, weighing half a pound each, are sometimes observed. It is only during the month of May that salmon are noticed on this shore. One weighing 16 pounds, taken in a pound net at this place in 1891, sold for $11; the following year two, with a combined weight of 23 pounds, sold for $15.98.

In the vicinity of Long Branch, we are informed of the recent capture of a number of salmon in the pound nets set directly in the ocean. Mr. Ed. Hennessey, of North Long Branch, reports that in 1892 two salmon and in 1893 one salmon were taken in his pound; they weighed from 10 to 15 pounds each. In April, 1891, Messrs. Gaskins and Hennessey, of the same place, secured a salmon in their pound; this was the only one they ever took. Messrs. W. T. Van Dyke & Co., pound-net fishermen of Long Branch, communicate the following instances of the taking of salmon by them in 1893: May 10, 1 salmon weighing 9½ pounds; May 11, 1 salmon weighing 13½ pounds; May 17, 1 salmon, and May 18, 1 salmon, weight not given. Messrs. West and Jeffrey, pound-net fishermen at Long Branch, report that in 1892 they caught 2 small salmon. In 1893, 3 fish were taken, as follows: May 10, a salmon weighing 19 pounds; May 18, 1 weighing 12 pounds; May 20, 1 weighing 10 pounds. Mr. Henry F. Harvey, who fishes a pound net at Mantoloking, N. J., about 35 miles south of Sandy Hook, communicates the information that in May, 1893, 2 salmon weighing 10 or 12 pounds each were taken at that place. None had ever before been caught there.

One of the most interesting facts at hand concerning the oceanic occurrence of the salmon has been noted in a previous paper in this Bulletin,* but may be again referred to in order to make the present article more complete. Instances of the capture or observation of salmon far out at sea or even at relatively short distances from land are very rare and are entitled to publication whenever noted. About April 10, 1893, the mackerel schooner *Ethel B. Jacobs*, of Gloucester, Mass., was cruising for mackerel off the coast of Delaware. When in latitude 38°, at a point about 50 miles ESE. of Fenwick Island light-ship, the vessel fell in at night with a large body of mackerel, and the seine was thrown round a part of the school. Among the mackerel taken was an Atlantic salmon weighing 16 pounds, which Capt. Solomon Jacobs, who was in command of the schooner, sent home to Gloucester. Capt. Jacobs informs us that the fish was fat and in fine condition. Some of the crew told the captain that there was another salmon in the seine, but it escaped over the cork line as the seine was being "dried in." The light-ship mentioned is about 10 miles off the coast, so the place where these salmon were taken was about 60 miles from the nearest land.

The foregoing is the only instance known to this Commission of the capture of salmon so far at sea on the coast of the United States or of the taking of salmon in a purse seine with mackerel under any circumstances. Capt. S. J. Martin, the veteran fisherman of Gloucester, Mass., has never known of another such occurrence, and a special inquiry conducted by him among the mackerel fishermen of that port failed to disclose the knowledge among them of a similar case.

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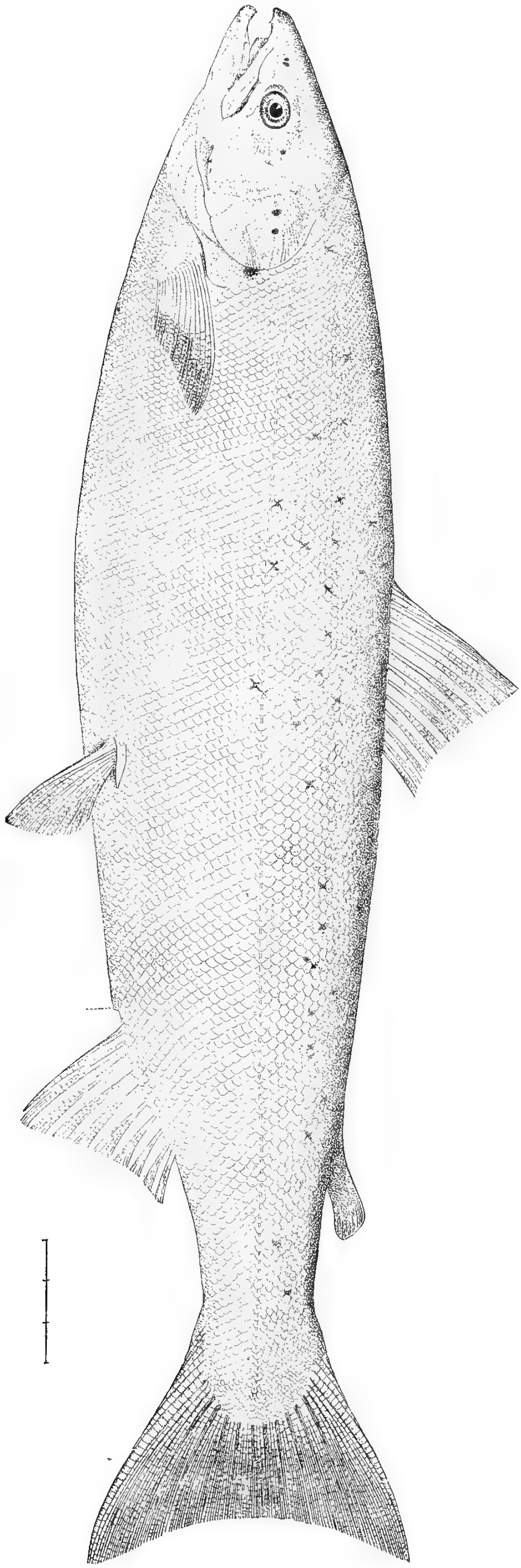
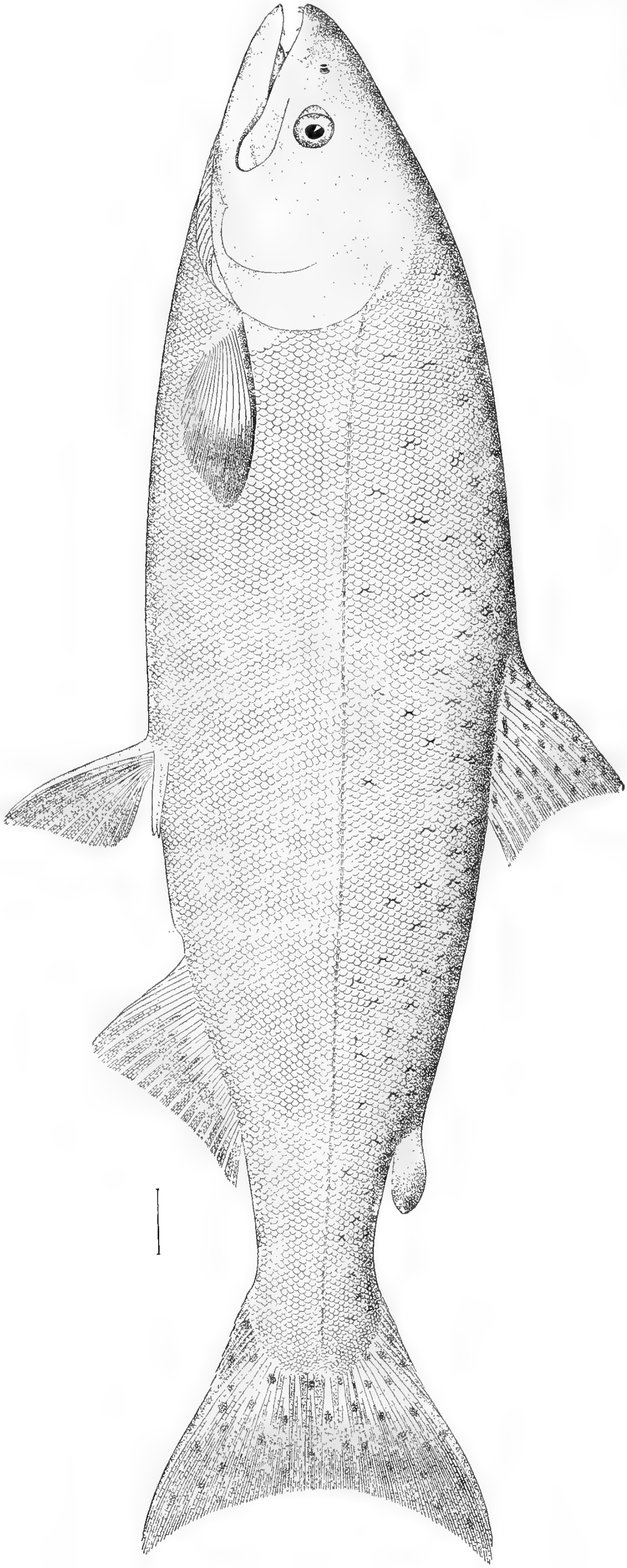
*Extension of the Recorded Range of Certain Marine and Fresh-water Fishes of the Atlantic Coast of the United States.

PLATE 3.



THE ATLANTIC SALMON (*Salmo salar*).



THE PACIFIC SALMON (*Oncorhynchus chouicha*)

11.—RESULTS OF EXPLORATIONS IN WESTERN CANADA AND THE NORTH-WESTERN UNITED STATES.

By CARL H. EIGENMANN,
Professor of Zoology, Indiana University.

INTRODUCTION.

During August and part of September, 1892, I made a series of collections of fishes between Winnipeg and Vancouver in Canada, and between Umatilla, Oregon, and Poplar, Montana, in the United States. Collections were made at 25 different places distributed as follows: 5 stations in the basin of the Red River of the North, 1 in the basin of Lake Manitoba, 6 in the Saskatchewan basin, 7 in the Columbia basin, 4 in the Fraser basin, and 2 in the Missouri basin. I thus collected material for a comparison of the fish faunas of the streams flowing into Hudson Bay and into the Gulf of Mexico on the Atlantic slope, and into Puget Sound and into the Columbia on the Pacific slope. The conclusions based on my observations are, of course, merely tentative, for many other species will probably be found in the streams examined.

Nineteen stops were made in Canada along a line which runs nearly west from Winnipeg, *i. e.*, along the Canadian Pacific railway. On the Atlantic slope I collected from an elevation of 700 feet at Winnipeg to an elevation of 4,500 feet at Banff, in the Rocky Mountains Park, and on the Pacific slope from an elevation of 4,050 feet at Field to 300 feet at Umatilla on the Columbia system, and from 1,900 feet at Griffin Lake to tide water at Mission in the Fraser system.

The streams on the Atlantic side in Canada belong to one river system, since the Red River and the Saskatchewan are united in Lake Winnipeg and there is a direct communication between the Qu'Appelle River and the Saskatchewan.* I was informed that a similar relation exists between the headwaters of the Saskatchewan and the Milk River, thus connecting the Winnipeg system with the Mississippi system. The connection is said to lie in a marshy meadow to the west of the Cypress Hills; and should this be a fact, the Mississippi, Saskatchewan, and Columbia † would form one gigantic water system similar to that formed by the Orinoco, Amazon, and La Plata, with the difference that the Pacific slope is included in the North American system. The great similarity of the fauna of the Saskatchewan to that of the Missouri lends

* H. Youle Hind, Canadian Red River and Assiniboine and Saskatchewan Expedition (London, 1860), p. 355: "We soon found a pond from which we observed water flowing to the Saskatchewan and the Assiniboine. The pond is fed by a number of springs and small streams, a foot or two broad, issuing from the sand hills at right angles to the valley."

† For a full and interesting account of the connection between the headwaters of Snake River and the Yellowstone, see Evermann, Report of the Commissioner of Fish and Fisheries respecting the establishment of fish-cultural stations in the Rocky Mountain region and Gulf States, p. 22, 1892.

color to the claimed connection between these two systems. The connection between the Missouri and the Columbia has scarcely affected the distribution of fishes.

The region from Winnipeg to Calgary is very much like any section in the United States from the Mississippi to the Rockies. The slope for the most part is imperceptible and the country is level or slightly rolling. A large part is prairie, the rest is covered with low shrubs. The rivers have usually worn a narrow valley below the general surface, and their banks are nearly always quite abrupt and very muddy. From Calgary the ascent is rapid and the streams become mountain torrents.

On the Pacific slope the streams are all swift, and from Field to the Columbia the descent is very rapid. The Columbia is navigable from Golden up, but below Golden there are many rapids. This river makes a long horseshoe bend towards the north, and when the railway strikes it again at Revelstoke the river is 1,000 feet lower and again navigable.

I received much valuable information and many courtesies from Mr. McQueen, inspector of fisheries for Manitoba; from Mr. W. Hill, of Winnipeg; Mr. Amedée E. Forget, of the Canadian Indian department; Capt. Harper, of the Canadian mounted police, and Mr. G. A. Stewart, superintendent of the Rocky Mountains Park of Canada.

Finally, I must acknowledge my indebtedness to Dr. Albert Günther, of the British Museum, at whose suggestion and expense the explorations were undertaken.

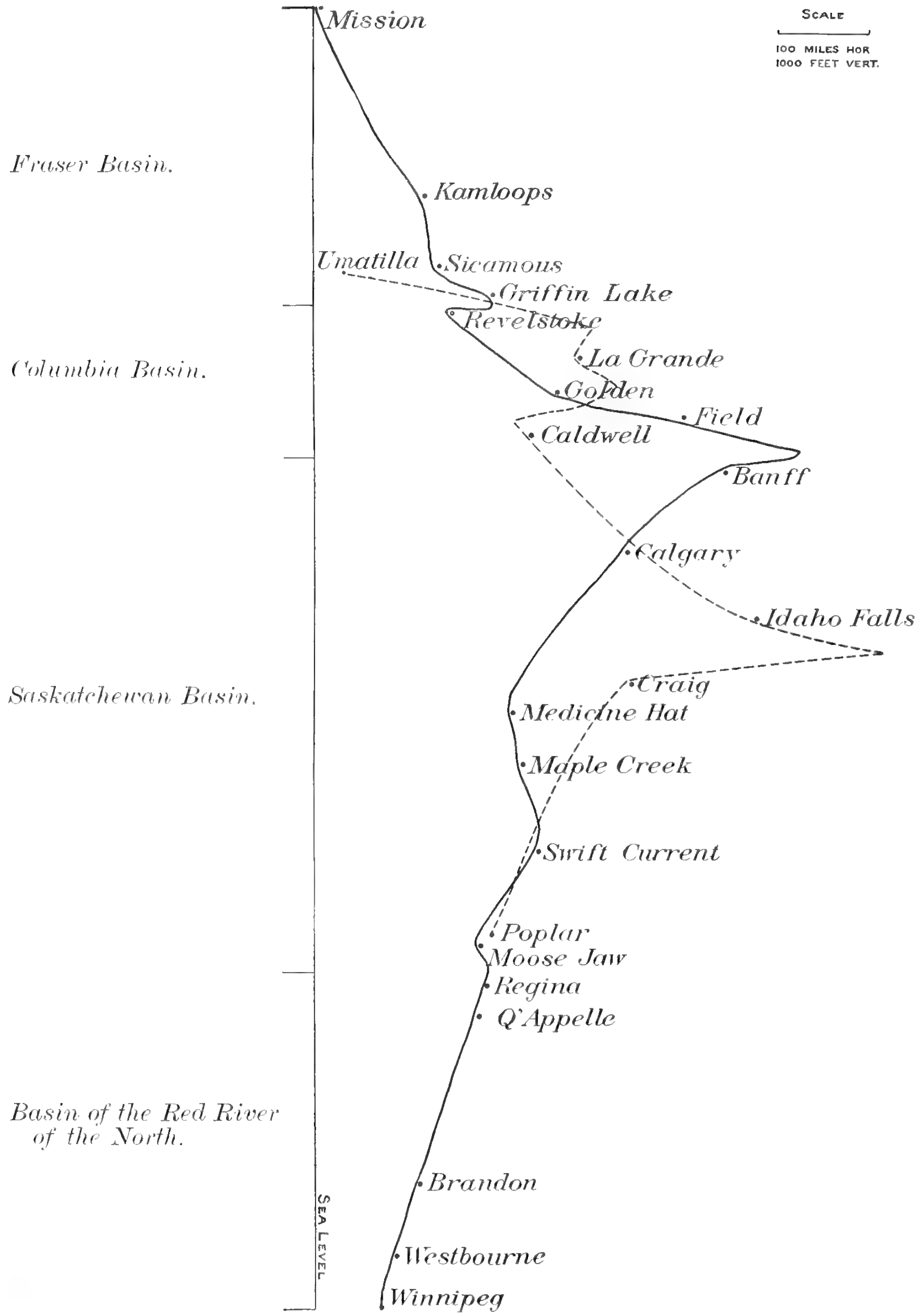
STATIONS WHERE COLLECTIONS WERE MADE.

In the following list I give the names of the places visited by me in their regular succession, the name of the river examined, the system to which it belongs, and, as far as I have been able to determine, the elevation of each locality. All the elevations of Canadian points have been taken from the levels of the Canadian Pacific Railroad. Plate 5 illustrates the relation of these stations to each other.

Station.	Elevation.	Stream.	River system.
Canada, Atlantic slope:			
Winnipeg	700	Red River of the North	
Westbourne	*750	White Mud	Manitoba Lake.
Brandon	1,150	Assiniboine	Red River.
Qu'Appelle	*1,700	Qu'Appelle	Do.
Regina	1,875	Lacawana Creek	Do.
Moose Jaw	1,725	Moose Jaw	Do.
Chaplin	....	Old Wives Lake	
Swift Current	2,400	Swift Current	Saskatchewan.
Maple Creek	(?) 3,800	Maple Creek	Do.
Medicine Hat	2,150	Saskatchewan	Do.
Calgary	3,388	Bow and Elbow	Do.
Banff	4,500	Bow and Vermillion	Do.
Canada, Pacific slope:			
Field	4,050	Kicking Horse	Columbia.
Golden	2,550	Kicking Horse and Columbia	Do.
Revelstoke	1,475	Columbia	Do.
Griffin Lake	1,900	Griffin Lake	Fraser.
Sicamous	1,300	Shushwap Lake	Do.
Kamloops	1,158	Thompson River	Do.
Mission	1	Fraser	Do.
United States:			
Umatilla	300	Umatilla Creek and Columbia	
La Grande	2,786	Grand Ronde	Columbia.
Caldwell	2,372	Boise	Do.
Idaho Falls	4,712	Snake River	Do.
Craig	†3,438	Missouri	Missouri.
Poplar	†1,960	Poplar River	Do.

* About.

† Elevations furnished by Great Northern Railroad through its general manager, Mr. D. L. Mohler.



RELATIVE LONGITUDINAL AND ALTITUDINAL POSITIONS OF THE POINTS WHERE COLLECTIONS WERE MADE.

The continuous line represents the Canadian points. The river basins to which these points belong are indicated beneath the sea-level line. The broken line connects the United States points. All those west of the highest point belong to the Columbia Basin; all those to the right belong to the Missouri Basin.

DESCRIPTION OF LOCALITIES IN THE ORDER OF EXPLORATION.

CANADA.

The region about Winnipeg is a flat prairie about 25 or 30 feet above the river. The bed and banks of the Red River of the North are muddy in the extreme and full of stumps and snags. In seining, where we did not sink into the mud beyond possibility to work, snags were sure to interfere. An old French fisherman has cleared the snags from a short stretch of bank, and here from morning till night he drags a seine over the same ground, making about 20 hauls during the day. The abundance of fishes is evident from the fact that a number are taken with every haul. The principal species are the gold-eye (*Hiodon*), which is smoked and dried; the various suckers and buffalo; the pickerel (here the species of *Stizostedion* go by this name); the pike (*Lucius*), sturgeon, and catfish. The last are extremely abundant, and are taken in quantity with hand lines.

The White Mud River at Westbourne is tributary to Lake Manitoba. It is a narrow stream, 60 to 80 feet wide, and swift. There are pebbly weed-covered stretches, alternating with deep muddy pools. The country about Westbourne seems to be low and swampy. *Lucius lucius* is reported to ascend in such numbers to spawn that they can be shoveled out.

The Assiniboine at Brandon meanders through a valley about a mile wide. The stream itself is swift and between 200 and 300 feet wide. The current changes with every bend, now approaching one side, now another. The bottom of the stream is gravelly in places, but for the greater part the soft mud is 2 or more feet deep. I did not learn of any fishing here for the market.

In order to reach the Qu'Appelle River it was necessary to ride nearly 20 miles by stage. The road is over a wind-swept prairie, with clumps of low shrubs. At longer or shorter intervals there are shallow depressions which resemble enormous sink holes of limestone countries. Nothing is seen of the Qu'Appelle Valley till one is at its brink, where, about 300 feet below the general level of the prairie, lies the valley of the Qu'Appelle, or "Who Calls" River. The valley is over a mile wide and is flanked by abrupt walls. It is occupied by a series of four lakes having an average depth of about 43 feet. The latter are connected by a swift, clear stream only 15 to 20 yards wide. They abound in fish. *Etheostoma nigrum* flourishes in perfection in the stream connecting the lakes. Two species of whitefish (*Coregonus*) are taken in these lakes, but I was unable to obtain any specimens.

The country about Regina is mostly a level prairie. Lacawana Creek is a small stream about 4 yards wide. Its bed is very muddy, so much so that it was almost impossible to draw a net. The banks are abundantly supplied with various water weeds. Near the town the stream has been dammed to form a reservoir for the city. The bank of the reservoir nearest the city has a strip of chara about 20 feet wide. These chara fields harbored thousands of *Pimephales* and a few *Eucalia*. Below the dam a single haul of the seine secured about a peck or more of *Eucalia*. Only four species were taken at this place. Suckers, and especially pike (*Lucius*), are said to be very abundant during their breeding season or in the early spring.

About Moose Jaw there are rolling hills. Above the town, Moose Jaw Creek flows through a narrow valley or gorge; near the station it joins Thunder Creek, a smaller stream. As is usual along the railroad, the stream is dammed near the station. Below the dam it forms a succession of deep pools and shallow riffles. The conditions seemed favorable for a large variety of fish life, but the number of species obtained was very small. The larger species are more abundant here than the smaller.

Old Wives Lake is alkaline, and as far as I could determine contains no fishes.

Swift Current is an ideal place for variety in fish life. The stream is narrow and on an average about 2 feet deep. It flows over gravel and, as the name implies, has a swift current. It is just such a stream as the darter delights in in more southern latitudes, and in fact one of their number, *Etheostoma iowæ*, is quite abundant here. This is the only darter, however, that I obtained in the waters of the Saskatchewan Basin. The stream is dammed above the railway, and it is just below the dam that the most favorable locality for fishing was found.

At the time I visited Maple Creek it consisted of a succession of slimy pools in a moderately deep channel. There was an almost incessant cold rain that prevented much work, but although 1½ inches of water fell during my stay, no impression whatever was made on the quantity of water in the pools. Maple Creek empties into Big Stick Lake which, in high water, overflows into a tributary of the Saskatchewan.

The Saskatchewan River at Medicine Hat is a navigable stream with a swift current. The water is cold and cloudy. Many of the larger species of fish were reported to me here, although I obtained but few. The river bed is said to be 1,600 feet lower than that at Maple Creek, the descent during the last few miles before reaching the river being considerable. The bed of this river lies in a level valley of varying width. At Medicine Hat the low hills approach almost to the edge of the river.

Calgary lies in the V formed by the junction of the Elbow with the Bow River. Both of the rivers are swift, clear, cold mountain streams, the former being the shallower. Trout, *Salmo* and *Salvelinus*, are abundant. Seining in the Bow River proper was impossible, and it was confined to the sloughs of that river and to the Elbow. The country is hilly and devoid of timber. The Rockies are seen from here.

From Calgary to Banff there is a steady ascent. Banff is located on the Bow River and in the Canadian Rocky Mountains Park.

The valley of the Bow is swampy for several miles above Banff, and the Bow River itself is a quiet deep stream. At Banff it becomes a torrent in which fishing with a net is impossible. The valley is everywhere quite narrow and flanked by high mountains. Vermillion Creek, the outlet of the Vermillion Lakes, which lie in the swamps of the Bow, enters the Bow at Banff, as also does Forty-Mile Creek. These tributaries are clear and icy cold. On the opposite side a small stream of warm water enters from the hot sulphur springs, and a much larger stream, the Spray River, which is, however, too swift for seining. The larger streams all abound in *Salmo mykiss*, *Salvelinus namaycush*, and *Coregonus williamsoni*.

From Banff the ascent is very rapid to the continental divide. The descent on the Pacific side is even more steep. My first station on the Pacific side was at Field, where the mountains rise 10,000 feet above the river. The river bed of the Kicking Horse, at Field, is a broad sandy stretch and the water flows in several channels. The main stream is too swift for seining, but the smaller branches are quieter in many

places. The icy water of the Kicking Horse is milky in appearance and full of a tough clayey substance. But two species of fishes were obtained here, *Coregonus coulteri* and *Cottus philonips*, both new to science.

At the mouth of the Kicking Horse, at Golden, other collections were made. The Columbia River above this place is navigable for small steamers. Below Golden it becomes a narrow torrent. Collections were made in a meadow overflowed by back water from the Columbia, and in the Columbia at the mouth of one of the branches of the Kicking Horse. The valley of the Columbia here slopes up to a range of low pine-clad mountains extending parallel with the stream. Salmon (*Oncorhynchus*) ascend to this point.

At Revelstoke the Columbia is a much larger stream and very swift. To the west a series of high mountains are seen which form the watershed between the Columbia and the Fraser. On the east the ascent is more gradual.

Griffin Lake is the last of a series of small lakes beginning just beyond the divide between the Columbia and the Fraser. It is a very clear lake, shallow near the shores. It is about a mile wide and about 2 miles long. All sticks lying in it are covered with a bright green sponge. Great clusters of the same sponge, a foot high and about the same width, are seen on the bottom in shallow water. Fish life is not abundant. From its banks low mountains rise. The stream flowing from it is swift and full of young *Salmo*. A rudimentary dam has been constructed at its outlet to keep timber from floating down against the railway bridge. As a consequence the lake is full of snags. The outlet of Griffin Lake empties into Eagle River, which in its turn empties into Shushwap Lake.

Sicamous is a station on an arm of Shushwap Lake near the mouth of the Eagle River. Low mountains covered with pines ascend from all the shores of the lake. The water of the lake is much warmer than that of the Eagle River. The bottom is overgrown with water weeds which seem in some places to be 20 feet or more in height. Fish are very abundant and schools of them swim below the surface, frequently a whole school poking their heads up together, like schools of frightened anchovies.

At Kamloops the North Thompson River empties into Thompson River, forming together a stream nearly a mile wide. The current is moderate, and formerly steamboats plied on the river. The margins of the stream are full of waterweeds, through which it is impossible to draw a net. Salmon are taken here by the Shushwap Indians. The valley is skirted by rounded hills which, with the exception of scattered pines, are devoid of trees. The water is much warmer than in the mountain streams, though the exact temperature was not obtained.

Soon after leaving Kamloops the descent again becomes very steep and continues so along the Fraser to Mission, where the river is affected by high tides. The country south of Mission is marshy, a few hills rising on the north. The Fraser is here a slow, broad stream, and salmon and sturgeon abound in it.

UNITED STATES.

The region about Umatilla is a rolling prairie. The banks of the Columbia River are sandy and gravelly. The Umatilla River is small and empties into the Columbia. About its mouth is an estuary with a soft mud bottom and with from 2 to 3 feet depth of water. The mud and some waterweeds usually filled the net so that it was difficult to pick out the fish, especially as it was necessary to collect after dark. The most important discovery of the season was made at this point. *Columbia transmontana* shows in a striking way the modification of the fins of the Pacific slope fishes. In this case it has found expression in the strong spines at the origin of the anal and the dorsal fins.

The Grand Ronde River is a tributary of the Snake. At La Grande it is a small stream with a few deep holes. It is dammed near the town for milling purposes, is full of angular pieces of lava, and seining is almost impossible. Below the dam large numbers of *Ammocœtes* were found dead.

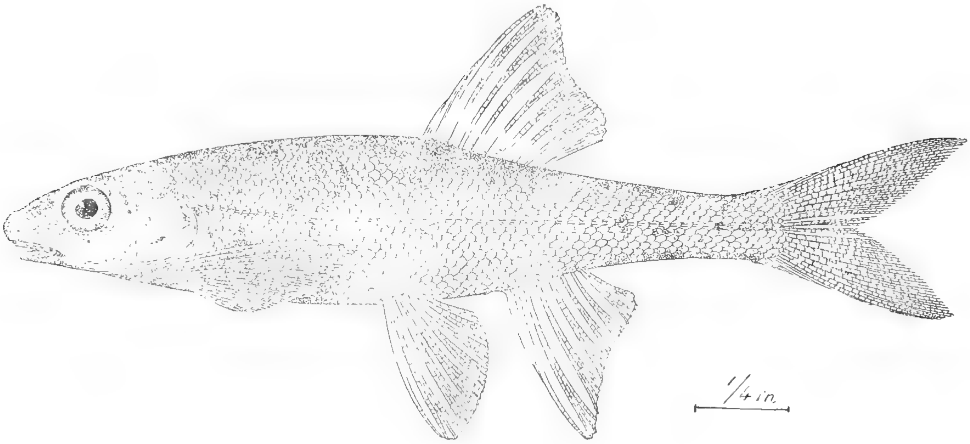
About Caldwell the country is a level plateau, treeless except along the river banks. The Boise River, which is a swift stream about 100 feet or less in width, is dammed at various places to divert the water into irrigating ditches. There are level stretches in the river, alternating with swift riffles.

At Idaho Falls the Snake River has worn a narrow gorge through the lava, and is a fierce torrent in which seining was out of the question. Fortunately a small stream has been diverted for a mill, and in this I obtained probably a complete series of the fishes of this region. The country is still a level valley with mountain ranges at a distance on either side.

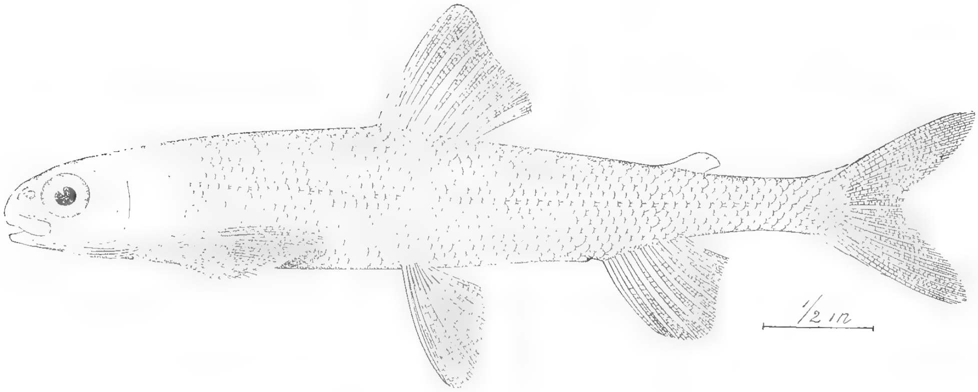
Soon after leaving Idaho Falls the continental divide is crossed. The first station at which I made collections was Craig, Mont., on the Missouri. This river is here about 150 feet wide, a clear, cold, rapid stream with gravel bottom and full of *Coregonus williamsoni* and *Platygobio gracilis*. Fishing was confined chiefly to the slough formed at the mouth of a small creek entering from the eastern side.

At Poplar the Missouri is a swift, muddy stream, probably 200 yards or more wide. Poplar River is also muddy and partakes of the nature of the prairie streams near Winnipeg; that is, its banks are composed of soft mud. It seemed nowhere over 5 feet deep, and in many places it was only a foot deep.

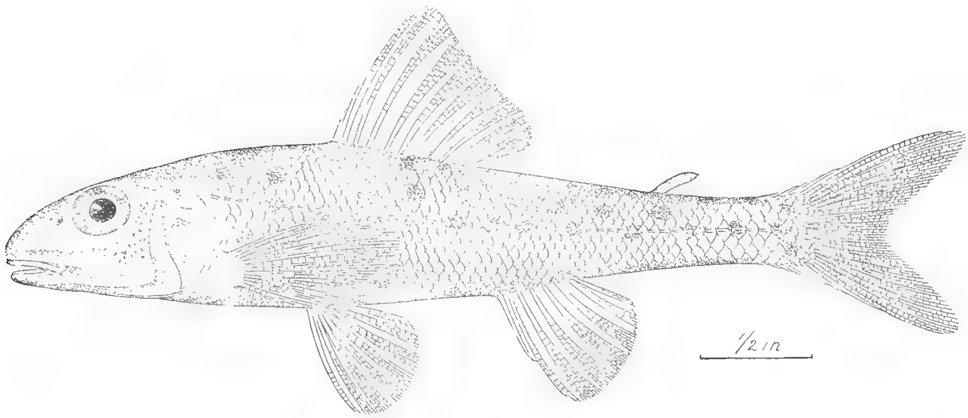
PLATE 6.



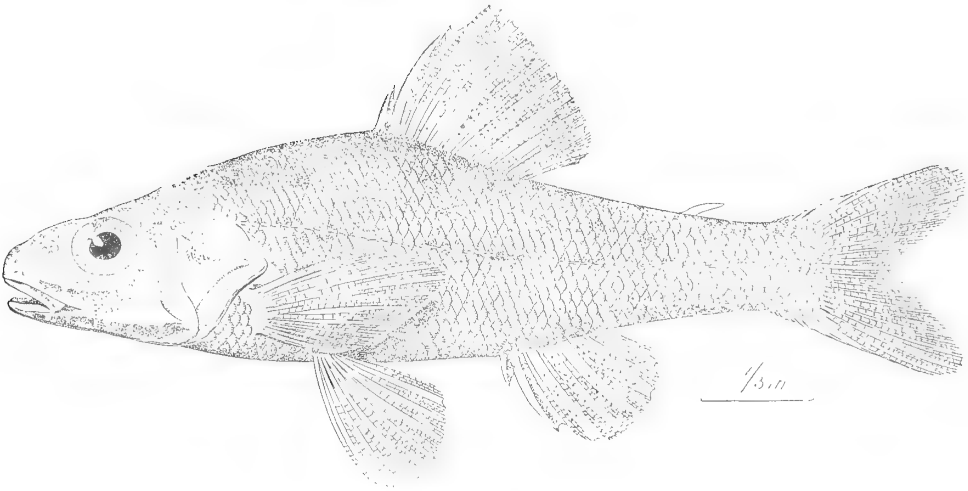
AGOSIA FALCATA Eigenmann & Eigenmann.



COREGONUS COULTERI Eigenmann & Eigenmann.



PERCOPSIS GUTTATUS Agassiz.



COLUMBIA TRANSMONTANA Eigenmann & Eigenmann.

NOTES ON THE FISHES COLLECTED.

1. **Ammocœtes tridentatus** (Gairdner). This species ascends the rivers to spawn. At La Grande the Grand Ronde, a small stream 5 or 6 yards wide, is dammed for milling purposes. Just below the dam a large number of this species were noticed in all stages of decay. Some had evidently died the preceding night. The ovaries of those taken at this place were large, but the eggs were quite small. Whether the "eels" had spawned and died, or whether the specimens were left stranded, I am unable to state. All the specimens were about 600 mm. long. At Caldwell I secured a large number of the young of this species. The largest of these measured 60 mm. In their habits the young very much resemble *Branchiostoma*. They burrow in the sand near the margin of the stream. If they are disturbed they will come out of the sand a few centimeters from the place of disturbance. The small ones were procured by throwing the sand on the banks, whereupon they would squirm out and could be secured.

2. **Acipenser sturio** Linnæus. This species is common at Winnipeg and in the lakes to the north. I procured a single specimen 96 mm. long. It has the upper part of the snout black, a black spot on the sides above the posterior third of pectorals, and another below the dorsal; a narrower dusky band connects these and extends to the tip of the tail.

3. **Noturus flavus** Rafinesque. A number of specimens of this species (150 to 250 mm. long) were obtained with hook and line at night in the Missouri River at Craig, Mont. This seems to be the most western record for any members of the *Siluridæ*. They were reported to me at Medicine Hat, but I did not procure any specimens at that place. Prof. Evermann reports none in his explorations in Montana and Wyoming. It has hitherto been supposed that the members of this family do not ascend to the mountains. None have been found indigenous to the Pacific slope. In the larger specimens the two maxillary barbels reach the base of the pectorals. There is uniformly a white spot on the back just at the base of and behind the last dorsal ray.

4. **Ictalurus punctatus** Rafinesque. Winnipeg. Exceedingly abundant in the Red River, where it is caught in great numbers, especially at night. It frequently reaches a length of about 750 mm. It was reported to me at Brandon, but it can not be abundant at that place, since none were said to have been caught there since 1883. A catfish was also called to my attention at Medicine Hat, but from the description it must be a *Noturus*.

5. **Ictiobus cyprinella** (Cuvier & Valenciennes). Winnipeg. Two specimens, the largest 760 mm. long.

6. **Carpiodes velifer** (Rafinesque). Winnipeg, Brandon, Medicine Hat, Poplar. I can detect no differences between the specimens from Winnipeg and some taken in the Ohio River at Cincinnati.

7. **Pantosteus jordani** Evermann.

(*Pantosteus columbianus* Eigenmann & Eigenmann, Am. Nat., Feb., 1893.)

Three specimens, 92 to 100 mm. long, Boise River, Caldwell, Oreg. Very closely related to *P. generosus*, the eye slightly larger, the caudal much longer. Head, $4\frac{2}{5}$–$4\frac{3}{5}$; depth, $4\frac{1}{2}$–5; D. II, $11\frac{1}{2}$–$12\frac{1}{2}$ (in two); A. I, $8\frac{1}{2}$ ($7\frac{1}{2}$ in *generosus*). Scales, 16 to 19–80 to 100–15. Eye, $1\frac{1}{2}$–2 in snout, $1\frac{2}{5}$–$1\frac{3}{5}$ in interorbital, $3\frac{3}{4}$ to little more than 4 in head ($2\frac{1}{2}$; $3\frac{2}{3}$; $4\frac{1}{2}$ in *generosus* of same size). All the fins more pointed than in *generosus*, the caudal lobes considerably longer than the head (shorter than head in *generosus*), $3\frac{2}{3}$–$4\frac{1}{5}$ in the length (5–$5\frac{1}{2}$). Light brown with indistinct clouds of darker.

8. **Catostomus catostomus** (Forster). Winnipeg, Swift Current, Medicine Hat, Calgary, Banff, Golden, and Revelstoke. Ascends streams to spawn. Is said to be very abundant at Winnipeg during the winter. Only a single specimen, the first of the season, was taken during my stay. As will be seen from the above localities, the species extends across the Rockies. A specimen of *catostomus* 290 mm. long, from Golden, on the Columbia River, differs in only a few minor details from a specimen of *Catostomus catostomus* of about the same size, the origin of which is not known. A series of larger specimens will probably show perfect intergradation. In the Golden specimen the eye is more anterior than in the other; and this feature changes all the proportions of the head. The size of the eye is the same in both; $6\frac{1}{2}$ in the length of the head, 2 in the postorbital portion in the Golden specimen ($2\frac{1}{3}$–3 in the other), about $2\frac{3}{4}$ in the snout ($3\frac{1}{4}$); middle of head behind anterior margin of pupil (at anterior

margin of eye); depth of head greater than length of snout plus eye (depth of head less than snout plus eye); scales of breast obscure, imbedded forward (scales of breast regularly imbricated, not imbedded); margins of lower fins all well rounded, all of them shorter than in typical *catostomus* (margins of lower fins all more angular, some of the rays being longer than others). Distance of end of superciliary mucous canal from transverse nuchal canal twice as great as in the typical form. Such differences would be considered of no value for purposes of classification in specimens from the same river system, and indeed I am not able to find any tangible differences between specimens 190 mm. long from the Columbia at Revelstoke and the Bow at Calgary or the Swift Current. The larger specimen has the back and sides quite dark, centers of the scales toward the belly white; belly entirely white. A reddish band along the lateral line. The young from all localities are mottled gray.

9. Catostomus griseus (Girard). Swift Current, Medicine Hat, Craig. One specimen, 116 mm. long, was taken at Swift Current. Caudal as long as head, $4\frac{1}{5}$ in the length. D. II, $10\frac{1}{2}$. Sides to ventral surface dark-grayish, variously mottled. Lower surfaces, white. A number of specimens were taken at Medicine Hat, the largest 90 mm. long. These smaller specimens can readily be distinguished from *C. catostomus* of the same size by their much larger mouth, which very much resembles that of *Pantosteus*. The jaws are provided with horny or cartilaginous sheaths, making the resemblance to *Pantosteus* still greater.

10. Catostomus macrocheilus Girard. Sicamous, Kamloops, Umatilla, La Grande, Caldwell, and Idaho Falls. I saw a species of this genus in Griffin Lake, but was unable to secure it. In all probability it was *C. macrocheilus*, since this species was obtained a few miles farther west, at the mouth of the outlet of this lake. The largest specimen was obtained at La Grande, and measured 380 mm. It is quite dark to below the lateral line, where, from a line from just above the upper lip to the lower part of the caudal, the color abruptly changes to white. The pectorals, ventrals, and part of the anal are dusky, and a dusky bar extends upward from the base of the pectoral. The local variation in dorsal rays is well marked. Aside from the two undivided rays at the beginning of the fin the rays are as follows:

Locality.	Dorsal rays.					
	$11\frac{1}{2}$	$12\frac{1}{2}$	$13\frac{1}{2}$	$14\frac{1}{2}$	$15\frac{1}{2}$	$16\frac{1}{2}$
Sicamous		1	1	3		
Kamloops			2	3		
Umatilla			4	34	8	1
La Grande		2	2	1		
Caldwell			3	3		
Idaho Falls	1	3				

These last specimens approach *Catostomus ardens*.

11. Catostomus commersoni (Lacépède). Winnipeg, Westbourne, Qu'Appelle, Regina, Moose Jaw, Swift Current, Maple Creek, Medicine Hat, Calgary, Poplar. Very abundant everywhere. Scales, 55–69.

12. Moxostoma aureolum (Le Sueur). Winnipeg, Westbourne, Brandon, Poplar. Lower fins, and especially the caudal, red. D. $14\frac{1}{2}$ to $16\frac{1}{2}$. Specimens 240 mm., from Winnipeg, have the head 5 in the length.

13. Moxostoma anisurum Rafinesque. Winnipeg, Brandon. This species is much less abundant at Winnipeg than the preceding. The specimens measure from 90 to 285 mm. Head, $3\frac{1}{2}$ to 4. D. $16\frac{1}{2}$ or $17\frac{1}{2}$, counting all the rays. A. $8\frac{1}{2}$. Upper caudal lobe little longer than lower in the largest specimen. The largest specimen differs little from one obtained at Toledo, Ohio. Scales, 6–39 to 43–5. Color lighter than in the preceding species, no red on the fins.

14. Hybognathus placita Girard. Abundant at Poplar, but not seen elsewhere.

15. Acrocheilus alutaceus Agassiz & Pickering. Umatilla, Caldwell.

16. Pimephales promelas Rafinesque. Winnipeg, Westbourne, Brandon, Qu'Appelle, Regina, Swift Current, Maple Creek, Medicine Hat. Very abundant everywhere, especially so at Regina and Swift Current; least so at Qu'Appelle.

17 **Notropis jordani** Eigenmann & Eigenmann.

Notropis albeolus E. & E., Am. Nat., Feb., 1893; not *N. albeolus* Jordan=*N. megalops*.

A single specimen, 73 mm. long, obtained at Medicine Hat. This species is most closely related to *N. maculatus* and *N. heterodon*. In color it differs strikingly from the latter, agreeing in this respect with *maculatus*, except that it lacks a caudal spot and is less profusely spotted. The lateral line is much less complete than in *heterolepis*, and better developed than in *maculatus*. Head, 4; depth, 4⅓; D. 9½; A. 8½; scales, 4–35–4; 15 scales before the dorsal; teeth, 4–4, 1, 2. Two of the teeth feebly hooked, the two others with narrow imperfect grinding surfaces. The teeth on the right side are evidently abnormal, being arranged in three rows. Elongate compressed, more slender than *heterolepis*. Head much as in *heterolepis*, less convex above. Jaws equal; mouth oblique, the premaxillary on the level or lower margin of the pupil. Maxillary extending to anterior margin of orbit. Snout pointed, not decurved. Eye 3⅔ in head, 1⅓ in interorbital. Fins all small; origin of the dorsal over ventral, equidistant from base of middle caudal rays and nares, highest ray extending a little past end of the last ray when the fin is depressed, equal to head less snout; anal similar to dorsal, its highest ray equal to snout and eye; ventral equal to highest anal ray; pectorals longer, equal to head less opercle. Scales closely imbricated, the exposed edges little higher than long. Lateral line decurved, the tubes developed on less than 10 scales (some of those of the middle of the body are removed). General color silvery, no distinct markings. Ventral surface entirely white, a plumbeous lateral band overlaid with silvery. A dark vertebral line from occiput to caudal. Sides with a few dark specks, dorsal surface more densely specked, the margins of the scales darker.

18. **Notropis heterolepis** Eigenmann & Eigenmann. A specimen, 35 mm. long, taken at Qu'Appelle. This species is evidently closely related to *N. heterodon*, *N. anogenus*, etc. It differs from them strikingly in having tubes developed in but one or two scales of the lateral line, while all the scales along the lateral line on one side and all but one or two on the other are deeply notched on their posterior margins. Head, 4; depth, 4¼; D. 9½; scales, 5–35–4; 15 scales in front of dorsal. Teeth feeble, 4–4; grinding surface well developed on three teeth. Head subconical, little compressed, the snout rounded, little obtuse; the lower jaw included. Mouth little oblique, the premaxillary below the level of the lower margin of pupil. Maxillary almost reaching eye. Eye large, 1 in snout, 3⅗ in head, 1⅕ in interorbital. Dorsal inserted equidistant from base of upper caudal rays and anterior margin of eye, behind the last ray of the ventrals. Tips of the first rays much projecting beyond tips of last when depressed, the longest ray about equal to head less snout. Anal similar to dorsal, the longest ray about 1⅔ in head; ventrals reaching vent, equal to highest anal ray; pectorals equal to length of head less opercles. Scales loosely imbricated, almost imbedded in front of the dorsal. Scales along the median line (lateral line) with a deep notch near the middle of the posterior margins, the line nearly straight. A few black specks along base of anal; a dark line along lower margin of tail from anal to caudal. A dark band from tip of snout along the sides to the caudal; on the tail the band coincides in position with the scales of the lateral line. On the body it is placed a little higher. A conspicuous black curved line at the base of each scale of the lateral line. All the scales above the lateral band dotted with black. A narrow vertebral line from occiput to dorsal, a broad dusky band on the back between the dorsal and caudal, between which and the lateral band is a lighter band. Scales of the back with dark margins. Series of minute black dots along each ray of the dorsal, anal, and outer portion of pectoral; the dorsal and caudal quite dusky.

19. **Notropis (Minnilus) reticulatus** Eigenmann & Eigenmann.* Brandon, Qu'Appelle. This species is closely related to *N. spectrunculus*, *fretensis*, *nitidus*, and *topeka*, and may prove identical with one or the other. It approaches nearest *N. fretensis* and *topeka*. From the former it differs chiefly in the larger scales in front of the dorsal, and from the latter in the naked breast. Head, 4; depth, 4–4½; D. 9½ or 10½ (I or II, 8½); A. 9½ (II, 7½); scales, 4 or 5–34–3 or 4; 12–14 scales in front of the dorsal; teeth, 4–4, hooked, with evident grinding surface. Head pointed, broad above and slightly convex. Snout decurved, pointed, the lower jaw included. Mouth oblique, the premaxillary on a level with the lower margin of the pupil or somewhat lower.

*A larger series of specimens collected by Mr. A. J. Woolman in the headwaters of the Red River make it probable that this species is *N. deliciosus*.

Maxillary reaching front of orbit. Eye large, considerably longer than snout, 3 in head, greater than interorbital. Origin of dorsal over ventrals, equidistant from tip of snout and from base of upper caudal rays; longest ray scarcely extending beyond tip of last when depressed. Anal low, the longest ray not extending past tip of last ray when the fin is depressed, equal to snout and eye. Ventrals reaching vent, slightly longer than the highest anal ray. Pectorals little longer than head less opercle. Scales closely imbricated, the exposed edges considerably deeper than long in the largest specimens. Lateral line decurved, complete. Breast naked (scaled in *N. topeka*). A dark streak from anal to caudal, lower parts otherwise plain. A dark vertebral line, a plumbeous band along the sides, a faint spot at the base of the caudal about as large as the pupil. A series of spots along each side of the lateral line. Upper parts of sides and the back profusely spotted, the edges of the scales black, giving the whole part a reticulated appearance. The specimens from Qu'Appelle are darker than those from Brandon.

20. **Notropis deliciosus** (Girard). Three specimens of this species were taken at Winnipeg.

21. **Notropis megalops** (Rafinesque). A number of specimens of this species were obtained at Brandon. None were seen elsewhere.

22. **Notropis scopiferus** Eigenmann & Eigenmann. This species is evidently closely related to *N. luciodus*, from which it differs in the scaling and in having a conspicuous jet-black spot about as large as the pupil at the base of the caudal fin. Numerous specimens were obtained at Winnipeg, Brandon, Fort Qu'Appelle, and Medicine Hat. The species is most abundant at Fort Qu'Appelle, where the largest specimens (112 mm.) were obtained. Head, 4–4½ (longest in young); depth, 4¼; D. 9½; A. 10½ (the first two rays minute, unsegmented, and unbranched); scales, 6–36 to 42–4; 14 to 18 scales in front of the dorsal; teeth, 2, 4–4, 2; grinding surface very narrow, on two teeth. Compressed fusiform, the dorsal and ventral outlines about equally arched; highest point of back at first dorsal ray. Head heavy, compressed, flat above; snout blunt, much decurved. Mouth small, little oblique; the premaxillary below the level of the lower margin of the pupil; maxillary extending to anterior margin of eye. Eye large, longer than snout, 3 in head, little less than interorbital width. Origin of dorsal about equidistant from tip of snout and base of caudal; the highest ray extending much beyond tip of last when the fin is depressed, equal to the length of the head; caudal deeply forked, the lobes equal, longer than head. Anal similar to dorsal, but much lower, the highest ray about equal to the head less the snout; ventrals below the dorsal, reaching vent; pectorals about equal to the highest anal ray. Scales closely imbricated, but not notably deeper than long. Lateral line complete, and each scale with a well-developed tube. The line evenly and gently decurved to above origin of anal. All specimens, from the smallest (about 25 mm. long) to the largest, have a conspicuous black spot at the base of the middle caudal rays, a silvery lateral band, its dorsal margin distinct, its lower margin not distinct. Color otherwise variable; those from muddy water (Red River at Winnipeg) are bright silvery with very little dusky, the chromatophores being not less numerous, but contracted. The other extreme is found in the clear water of the Qu'Appelle. In these specimens there is a conspicuous vertebral band, and all the scales above the lateral line are most profusely dotted with black, the dots being largest at the margins of the scales. Top of head and upper parts of its sides similarly dotted. Dorsal, caudal, and upper parts of pectorals dusky. Specimens from Little Traverse Bay, Lake Michigan, seem to represent a variety of the species above described; the snout is more slender, the eye perceptibly smaller, and the caudal peduncle more slender. The difference is more marked in young examples, the form being much more slender than in *scopiferus* and the caudal spot notably smaller.

23. **Notropis jejunus** (Forbes). This species was found to be abundant at Winnipeg, Brandon, and Medicine Hat. The teeth are quite variable, being in different specimens 4–4; 1, 4–4, 2; and 2, 4–4, 2; otherwise there is little or no variation. It is not unlikely that some of the species described as having teeth 4–4, or 1, 4–4, 2 are identical with this species.

24. **Notropis atherinoides** (Rafinesque). Winnipeg, Medicine Hat, Poplar. The specimens from Winnipeg are slightly deeper than those from other localities, and all of the northern specimens have slightly larger eyes and correspondingly shorter snouts.

25. Rhinichthys dulcis (Girard). Swift Current, very abundant; Medicine Hat, few; Calgary, few; origin of dorsal equidistant from nostril and base of middle caudal rays. Banff, common in Bow River. One specimen has very much larger fins than the others, the pectoral quite reaching the anal. Also in hot sulphur springs, Banff, very abundant. Poplar, one specimen. Craig, abundant.

26. Agosia nubila (Girard). Idaho Falls, abundant.

27. Agosia falcata Eigenmann & Eigenmann. Abundant in the Boise River at Caldwell, Idaho; two specimens from Umatilla. In the following description the statements and figures given in parentheses refer to *A. nubila.* Head, $3\frac{3}{4}$–$4\frac{1}{5}$ ($4\frac{1}{5}$–$4\frac{1}{3}$); depth, $4\frac{1}{2}$–$5\frac{1}{4}$ (4–$4\frac{3}{4}$); D. $11\frac{1}{2}$ ($8\frac{1}{2}$–$11\frac{1}{2}$); A. $9\frac{1}{2}$ ($7\frac{1}{2}$–$9\frac{1}{2}$). Scales, 53–60 (59–67). Teeth, 1, 4–4, 1 or 2. Elongate, slender, head longer than in *nubila*. Eye much larger than in *nubila*, about $1\frac{1}{2}$ in snout, $3\frac{1}{2}$–$4\frac{1}{4}$ in head in larger specimens. The head being longer the proportional numbers do not differ from those of *nubila*. Scales much larger than in *nubila*, about 10 above the lateral line (14 in *nubila*). Dorsal usually inserted directly over the origin of the ventrals, the fin large, its anterior rays prolonged. Origin of dorsal equidistant from base of middle caudal rays and from nares. Caudal deeply forked, the lobes acute, $3\frac{3}{5}$ to $3\frac{4}{5}$ in the length. Anal very obliquely truncate, the anterior rays very high, $4\frac{1}{3}$–$4\frac{3}{4}$ (5–$5\frac{1}{2}$) in the length. Ventrals always more posterior in position than in *nubila*, about equidistant from base of middle caudal rays and from nares, their tips extending to or past middle of base of anal, $4\frac{3}{4}$–5 (5–6) in the length (reaching to vent, very rarely to origin of anal). Pectorals not reaching ventrals. A dark band forward from eye; dark, lateral band scarcely evident; silvery below; sides and back with numerous, irregular, well-defined blotches. Anal and sometimes ventrals with a dusky spot near base in front. Dorsal and caudal faintly mottled; crimson spots on mandible, axil of ventrals, and along base of anal. (Plate 6.)

28. Agosia falcata shuswap Eigenmann & Eigenmann. This variety seems well established by four specimens from Shushwap Lake at Sicamous. It is not at all improbable, however, that intergradations will be found. The specimens differ constantly in the more posterior position of the dorsal and ventrals; otherwise there is no difference of any note. Head, $3\frac{4}{5}$–$4\frac{1}{5}$; depth, 4–$4\frac{3}{4}$; D. $10\frac{1}{2}$–$11\frac{1}{2}$; A. $9\frac{1}{2}$. Scales, 10–55–8. Teeth, 1, 4–4, 2 in two specimens; 2, 4–4, 1 in another; and 2, 4–4, 0 in the fourth. Head pointed, the snout scarcely projecting beyond the mouth. Eye large, equidistant from tip of snout and from upper angle of gill-opening, the orbit about equal to the snout, $3\frac{1}{4}$–$3\frac{1}{2}$ in the head. Dorsal inserted directly over origin of ventrals, equidistant from base of middle caudal rays and from posterior half of eye. Its first two developed rays elongate, the margin of the fin strongly concave. Highest dorsal ray equal to distance from tip of snout to upper angle of opercle. Caudal long, deeply forked, the lobes finely pointed, the middle rays half as long as the lobes, at least as long as the head. Structure of anal similar to that of dorsal. Ventrals inserted equidistant between base of middle caudal rays and posterior half of eye, pointed, extending to middle of base of anal, equal to head less opercle. Pectorals less pointed than the other fins, as long as head or a little shorter. Light brown with numerous well-defined blotches, a dark band from tip of snout to base of caudal. All the fins with dark points along the rays collected in places, giving the fins a faintly mottled appearance.

29. Hybopsis storerianus (Kirtland). A number of small specimens from Winnipeg are probably to be referred to this species.

30. Couesius dissimilis (Girard). Very abundant at Swift Current, Medicine Hat, Calgary, Poplar. The specimens from Medicine Hat and from Poplar are quite light in color. Those from Calgary and from Swift Current are darker, the lateral band being well defined. Scales along the lateral line 58–62.

31. Platygobio gracilis (Richardson). Craig, Poplar, Brandon, Medicine Hat. This species is extremely abundant in the Missouri River at Craig, and in its tributary, Poplar Creek. A number were obtained with hook and line in the main stream at Craig, where the current is too swift for seining. In the slough at the same place none were seen. One was obtained at Brandon, and I was told that it is abundant at that place. Their projecting snout and frosted silvery color make them a striking species. The largest obtained measures 20 mm. There is a dusky vertebral band and a brown lateral one.

32. Mylocheilus caurinus (Richardson). Mission, Kamloops, Sicamous, Revelstoke, Golden, and Umatilla.

33. Ptychocheilus oregonensis (Richardson). Kamloops, Sicamous, Umatilla, La Grande, and Caldwell. Teeth usually 2, 4–4, 2. Dorsal with nine well-developed rays (I, $9\frac{1}{2}$).

Leuciscus and **Richardsonius.** The genus *Richardsonius* was proposed by Girard in 1856. It was said to bear some resemblance to *Squalius*, from which it could "be distinguished by the smooth edge of the dental ridge and the long anal, together with the peculiar position of the latter in reference to the dorsal. The dorsal is also much deeper than long, which is not the the case in *Squalius*." Species discovered since Girard's description was written have shown that no such differences between *Squalius* (*Leuciscus*) and *Richardsonius* exist. Dr. Günther classed the only two species of the genus *Richardsonius* with his *Abramis*, characterized by the elongate anal and compressed ventral ridge behind the ventrals. Jordan and Gilbert also separated the genus *Richardsonius* from *Leuciscus*, etc., on the basis of the compressed ventral ridge and elongate anal. I have examined a very large series of specimens and find that the ventral ridge is very variable, especially with age, and is of no worth whatever to separate *Richardsonius* even subgenerically from *Leuciscus*. In one specimen, which might have served Girard's artist when he drew *R. balteatus*, there is the merest vestige of a ventral ridge. The ridge seems best developed in specimens about medium size (75 mm.). The characters selected to separate the species of the old genus *Richardsonius* from each other seem no more fortunate. Neither the teeth nor the scales are of any value whatever in this respect. The anal fin is by no means an absolute guide, as will be seen later. In fact, I have been unable to detect a single character which will always separate the two forms, each of which is variable in the extreme. All those species of *Leuciscus* with increased number of anal rays, *montanus, hydrophlox, gilli, balteatus*, and *lateralis* may be classed under the subgeneric name *Richardsonius*. I find in examining 41 specimens of *Leuciscus montanus*, collected by Jordan at Provo, that in some the ventral ridge is much more developed than in typical specimens of *Richardsonius*. The anal rays are: 28 with 12½; 12 with 13½; 1 with 14½.

34. **Leuciscus atrarius** (Girard). This species is quite abundant in the Snake River at Idaho Falls. It readily takes the hook. The lateral line is not developed until late in life; in specimens 2 inches long the pores are formed on but few scales.

35. **Leuciscus hydrophlox** (Cope). Abundant in the Snake River at Idaho Falls. The anal rays in a number of specimens examined vary from 12½ to 14½. Two specimens have 12½ rays, fourteen have 13½, and four have 14½. The dorsal rays vary from 10½ to 11½, and the scales of the lateral line from 51 to 58. There is present a slight median keel behind the ventrals. These specimens agree very closely with specimens of *L. montanus* collected by Jordan at Provo, Utah, except that a larger percentage have 13 and 14 anal rays, and a smaller percentage have 12 rays.

36. **Leuciscus balteatus** (Richardson).

Cyprinus (*Abramis*) *balteatus* Richardson, Fauna Bor. Amer., III, 301, 1836; Storer, Synopsis Fish. N. A., 160, 1846.

Richardsonius balteatus Girard, Proc. Acad. Nat. Sci. Phila., VIII, 1856, 202; id., U. S. P. R. R. Exp. & Surveys, x, 278, pl. LX, figs. 1–4, 1859 (Fort Dalles, Oreg., Fort Vancouver, Oreg.?); Bean, Proc. U. S. Nat. Mus. 1882, 93 (Garrison Creek, Wash.); Jordan & Gilbert, Syn. Fish. N. A., 251, 1882 (Columbia River and northward); Jordan, Cat. Fish. N. A., 33, 1885.

Abramis (*Blicca*) *balteatus* Günther, Cat. Fish. Brit. Mus., VII, 309, 1868.

Of this species I obtained two unquestionable specimens at Kamloops. There is a distinct median ridge behind the ventrals, and the anal has 20½ and 22½ (II, 18½–20½) rays. Teeth, 2, 5–4, 2. At Mission this species is abundant, the largest individuals measuring 140 mm. In the larger specimens the postventral keel is very variable and frequently not at all distinguishable; it is best developed in medium-sized specimens (80 mm.). The teeth are usually 2, 5–4, 2, when normally developed. Of these, the anterior tooth on the left is thicker and shorter than the others, dagger-shaped, and remote from them. I have made detailed counts and measurements of over 20 specimens, and have counted the rays of all the rest. The anal rays are as follows: 16½ in two specimens; 17½ in seven; 18½ in thirteen; 19½ in twenty-five; 20½ in eighteen; 21½ in eight; 22½ in two; 23½ in two; 24½ in two. The usual number, then, is 19½ or 20½. The dorsal varies from 11½–13½. I have found no coördination of variations whatever. Each character varies independently. The scales vary from 11 to 13–53 to 63–5 to 7. According to the Mission specimens the normal number of anal rays is 19½ or 20½, and the variation is three or four rays in both directions.

The following table gives the measurements and some other variations found among the specimens of *Leuciscus balteatus* from Mission:

No.	Length in mm.	Dorsal.	Anal.	Scales.	Teeth.*	Depth.	Position of dorsal.	Sex.	Remarks.
1	140	$13\frac{1}{2}$	$18\frac{1}{2}$	12–59–6	....	$3\frac{1}{2}$	(†)	♀	Keel scarcely evident.
2	120	$12\frac{1}{2}$	$21\frac{1}{2}$	11–53–5	‡2, 5–4, 1	$3\frac{3}{5}$	(§)	♂	Median keel scarcely evident.
3	110	$13\frac{1}{2}$	$19\frac{1}{2}$	12–60–6	2, 5–4, 2	$3\frac{2}{5}$	(‖)	♂	Median keel moderate.
4	105	$12\frac{1}{2}$	$20\frac{1}{2}$	12–58–6	2, 5–4, 2	$3\frac{1}{4}$	(‖)	♀	Median keel well developed.
5	100	$12\frac{1}{2}$	$19\frac{1}{2}$	11–57–6	2, 4–4, 2	$3\frac{2}{3}$	(†)	♂	Keel typical.
6	102	$12\frac{1}{2}$	$18\frac{1}{2}$	12–60–6	2, 5–4, 2	$3\frac{1}{2}$	(§)	♂	Keel moderate.
7	91	$11\frac{1}{2}$	$20\frac{1}{2}$	12–57–5	2, 4–3, 1	$3\frac{3}{7}$	(‖)	♀	Keel evident.
8	92	$11\frac{1}{2}$	$19\frac{1}{2}$	12–58–6	2. 5–4, 1	$3\frac{3}{5}$	(‖)	......	Keel distinct.
9	88	$12\frac{1}{2}$	$19\frac{1}{2}$	12–61–6	2, 5–4, 2	$3\frac{2}{3}$	(‖)	♂	Keel well developed.
10	92	$12\frac{1}{2}$	$21\frac{1}{2}$	12–63–6	2. 5–4, 1	$3\frac{7}{8}$	(§)	♀	Keel typical.
11	102	$12\frac{1}{2}$	$20\frac{1}{2}$	11–62–6	2, 5–4, 2	$3\frac{3}{5}$	(§)	♂	Keel well developed.
12	87	$12\frac{1}{2}$	$20\frac{1}{2}$	13–59–6	1, 5–4, 2	$3\frac{3}{5}$	(†)	♂	Keel moderate.
13	86	$12\frac{1}{2}$	$20\frac{1}{2}$	11–59–7	2, 5–4. 1	$3\frac{1}{4}$	(‖)	♂	Keel well developed.
14	83	$12\frac{1}{2}$	$20\frac{1}{2}$	12–61–7	2, 5–4, 1	$3\frac{1}{2}$	(†)	♂	Keel no more than in *montanus*.
15	80	$11\frac{1}{2}$	$19\frac{1}{2}$	12–61–6	2, 5–4, 1	$3\frac{3}{5}$	(†)	♂	Keel distinct.
16	95	$12\frac{1}{2}$	$18\frac{1}{2}$	13–59–7	2. 5–4. 2	$3\frac{1}{2}$	(‖)	♂	Keel evident.
17	90	$12\frac{1}{2}$	$17\frac{1}{2}$	13–58–7	2, 5–4, 2	$3\frac{2}{3}$	(†)	♀	Keel moderate.
18	80	$11\frac{1}{2}$	$17\frac{1}{2}$	11–60–7	2, 5–4, 2	$3\frac{1}{2}$	(†)	♂	Keel typical.
19	77	$12\frac{1}{2}$	$17\frac{1}{2}$	57	2, 5–4, 2	$3\frac{1}{5}$	(†)	♀	Keel well developed.
20	87	$12\frac{1}{2}$	$16\frac{1}{2}$	13–61–7	2, 5–3, 2	$3\frac{2}{3}$	(§)	......	Do.
21	81	$12\frac{1}{2}$	$22\frac{1}{2}$	12–58–7	2. 5–4, 2	$3\frac{2}{3}$	(‖)	♀	Keel moderate.
22	80	$13\frac{1}{2}$	$21\frac{1}{2}$	61	2, 5–?	$3\frac{1}{5}$	(‖)	♀	Do.
23	74	$11\frac{1}{2}$	$16\frac{1}{2}$	....	2, 5–4, 2	....	....	......	Do.
24	60	$13\frac{1}{2}$	$24\frac{1}{2}$	....	2, 5–4, 2	$3\frac{1}{5}$	†	......	Keel evident.
25	68	$13\frac{1}{2}$	$24\frac{1}{2}$	....	....	....	....	......	
26	64	$12\frac{1}{2}$	$23\frac{1}{2}$	....	....	....	....	......	

* I have frequently observed that the largest individuals among the minnows usually have abnormal numbers of teeth.
† Equidistant from base of middle caudal rays and a point above middle of pupil.
‡ Anterior tooth of main row on left side is large, dagger-shaped, and remote from the others, and points inward.
§ Equidistant from base of middle caudal rays and upper angle of preopercle.
‖ Equidistant from base of middle caudal rays and posterior margin of eye.

Besides the above there are four with $17\frac{1}{2}$ anal rays; eleven with $18\frac{1}{2}$; twenty with $19\frac{1}{2}$; eleven with $20\frac{1}{2}$; five with $21\frac{1}{2}$; one with $22\frac{1}{2}$; one with $23\frac{1}{2}$. The largest number of specimens with increased anal rays were small individuals, about 70 mm. long.

37. Leuciscus balteatus lateralis (Girard). The specimens of this subspecies from the different localities will be considered separately.

1. *Sicamous.* A number of the specimens contain large parasitic worms. Eight specimens examined show the following measurements:

No.	Length.	Dorsal.	Anal.	Scales.	Teeth.	Position of dorsal.	Depth.
	mm.						
1	82	$12\frac{1}{2}$	$19\frac{1}{2}$	11–60–6	2, 4–3, 1	(*)	4—
2	92	$12\frac{1}{2}$	$16\frac{1}{2}$	11–62–6	2, 5–4, 2	Keel indistinct (*) ..	....
3	90	$12\frac{1}{2}$	$14\frac{1}{2}$	14–62–7	2, 5–4, 2	(†)	$3\frac{3}{5}$
4	87	$12\frac{1}{2}$	$17\frac{1}{2}$	12–60–5	2, 5–4	....	4
5	85	$12\frac{1}{2}$	$16\frac{1}{2}$	10–62–5	2, 5–5, 3	(‡)	$4\frac{1}{5}$
6	80	$12\frac{1}{2}$	$18\frac{1}{2}$	11–60–6	2, 5–4, 1	(*)	$4\frac{1}{4}$
7	85	$12\frac{1}{2}$	$16\frac{1}{2}$	11–59–5	2, 5–4, 2	(†)	4
8	77	$12\frac{1}{2}$	$17\frac{1}{2}$	11–61	2, 5–4, 1	(*)	$4\frac{1}{5}$

* Equidistant from base of middle caudal rays and upper angle of preopercle.
† Equidistant from base of middle caudal rays and a point above middle of pupil.
‡ Equidistant from base of middle caudal rays and occiput.

The total number of specimens collected at Sicamous was 58. They have the following number of anal rays: 1 has $14\frac{1}{2}$; 3 have $15\frac{1}{2}$; 13 have $16\frac{1}{2}$; 28 have $17\frac{1}{2}$; 8 have $18\frac{1}{2}$; 5 have $19\frac{1}{2}$. These specimens are a little more robust than those from Mission and are certainly more elongate, the depth in a number of them being $3\frac{3}{4}$–$4\frac{1}{4}$ in the length. They are more coarsely and profusely punctate. There is a conspicuous black lateral band, above which there is in some specimens a narrow light line, above which there is another darker shade. The ventral keel is moderately developed. In all the normal pharyngeals examined the teeth in the main row were 5–4. In one case the teeth are 2, 5–5, 3 which may be a case of reversion. This is unquestionably the species figured by Girard as *R. lateralis*. The average size of the specimens is smaller than that of *balteatus*.

2. Specimens from *Griffin Lake,* also undoubtedly *lateralis,* are similar to those from Sicamous in color and proportions, being probably slightly more compressed and deeper. Many specimens of this genus are bright scarlet on the sides. There were taken in Griffin Lake 14 specimens with anal rays as follows: 3 with 14½; 7 with 15½; 3 with 16½; 1 with 17½; 75 mm. or less in length. The teeth in the main row are in all but one doubtful case, 5-4.

3. Two specimens from *Kamloops* have the keel moderately developed, the teeth 2, 5-4, 2 and 2, 5-3, 2; the anal rays, 17½ and 18½.

4. One specimen from *Revelstoke* has teeth 2, 5-4, 1; anal, 15½; depth 4 in length.

5. *Golden.* The position of the dorsal fin does not vary materially in any of the specimens enumerated above, nor in *balteatus.* In all the specimens examined this fin was equidistant from base of middle caudal and from a point from above the middle of the eye to nearly the occiput. At Golden I obtained a number of specimens in which there is very great variation in this point. The dorsal is equidistant from base of middle caudal rays and from posterior margin of the eye in one extreme and from behind the occiput in the other. The specimens living in a milky river instead of a clear lake, as those at Sicamous, are much lighter and more uniform in color. The average number of anal rays is less than in the Sicamous specimens, as may be seen from the following table:

Measurement of specimens from the Columbia River at Golden, British Columbia.

No.	Length.	Dorsal.	Anal.	Scales.	Teeth.	Depth.	Head.	Position of dorsal.	Sex.	Remarks.
	mm.									
1	115	12½	15½	12-63-6	2, 5-4, 1	3¾	4¼	(*)	♀	Keel nil.
2	104	11½	16½	10-61-?	2, 5-4, 1	4	4⅓	(†)	♀	Keel evident.
3	103	11½	18½	10-55-5	2, 5-4, 2	4	4¼	(*)	♀	Do.
4	103	11½	17½	12-59-?	2, 4-5, 2	4⅕	4²⁄₇	(*)	♂	Do.
5	95	12½	15½	56	1, 5-4, 1	4	4⅓	(‡)	♀	Keel well marked.
6	92	11½	15½	....	....	4½	4¼	(§)	?	Keel well developed.
7	91	12½	17½	57	2, 4-3, 2	3¾	4⅓	(‡)	......	Keel nil.
8	85	11½	14½	....	....	4	4⅕	(‡)	......	Keel well developed.
9	85	12½	16½	....	....	4⅓	4⅖	(§)	......	Keel scarcely evident.
10	82	11½	16½	....	....	4¼	4¼	(*)	......	Keel evident
11	83	11½	16½	....	....	3⅚	4	(‡)	......	
12	77	11	15½	....	....	4¼	4¼	(‡)	......	Keel evident
13	73	12½	15½	....	....	4	......	(†)	......	Keel well developed.
14	72	10½	15½	....	....	4⅓	......	(‡)	......	Keel moderate.
15	68	11½	6½	....	....	4	......	(*)	......	Keel well developed.
16	67	12½	17½	....	....	3⅘	......	(‡)	......	Do.
17	65	12½	15½	....	....	4	......	(§)	......	Keel strong.
18	62	11½	17½	....	....	4⅓	......	....	......	Do.

* Equidistant from base of middle caudal rays and occiput (beginning of scaled region).
† Dorsal nearer base of middle caudal rays than occiput.
‡ Equidistant from base of middle caudal rays and upper angle of preopercle.
§ Equidistant from base of middle caudal rays and posterior margin of eye.

The dorsal in this lot has one or two spines.

Twenty-three specimens taken at La Grande, in the Grand Ronde River, vary from 32 to 108 mm. in length. Two have anal rays 14½; six have 15½; eleven, 16½; four, 17½. Depth, 3⅗-4; teeth in one specimen examined, 2, 5-4, 2; general color dark, markings well defined.

Thirty-three specimens from Boise River at Caldwell show the greatest variation in anal rays without any great specialization in one number. They are as follows: one with 14½; two with 15½; six with 16½; seven with 17½; eight with 18½; seven with 19½; two with 20½; and one with 21½. These specimens are rather flat and deep (depth 3½ to 3¾), approaching *L. balteatus* in this respect as well as in the number of anal rays. They are rather pale in color with the markings not distinct. Some of these specimens may belong more properly to *balteatus,* but I am not able to detect any differences save those mentioned. The ventral keel in most of these specimens is no more evident than in specimens of *L. montanus.*

Of nine specimens from Umatilla, Oreg., two have the anal rays 17½, four have 18½, and three, 20½.

38. Hiodon alosoides (Rafinesque). *Gold eye.* Poplar, abundant; D. 11½ or 12½, counting all rays; lateral line about 60; depth, 3⅓ to 3½. This species is very abundant in the Red River at Winnipeg; the largest specimen seen measured 370 mm.; head, 4⅘-5 in largest specimens (4¼-4½, in smaller, 230 mm.); depth about 3; D. 11½; A. 31-37; lateral line, 61. This species is here dried for the market; also taken at Brandon and reported to me at Medicine Hat.

39. Hiodon tergisus Le Sueur. Winnipeg, Brandon.

40. Coregonus williamsoni Girard. This species is extremely abundant in the Missouri River at Craig. It was also taken at Idaho Falls in the Snake River, at La Grande in the Grand Ronde; at Golden, Revelstoke, and Umatilla in the Columbia River; at Caldwell in the Boise River; at Calgary and Banff in the Bow River, where it is called grayling, and at Sicamous in Shushwap Lake. There are minute differences between the specimens taken at different places, but I am unable to distinguish specific characters to separate them.

41. Coregonus coulteri Eigenmann & Eigenmann. Many specimens, the largest measuring 195 mm., from the Kicking Horse, at Field, British Columbia; one specimen from Golden. Head, $4\frac{1}{3}$–5; depth, $4\frac{1}{2}$–$5\frac{1}{2}$; D. $10\frac{1}{2}$–$11\frac{1}{2}$; A. 12–13; scales 7, 60–63, 7 (to ventrals). Form rather heavy, little elevated, the snout broad, very blunt and decurved; greatest depth of head equals its length less the opercle. Mouth low, the snout but little projecting, maxillary reaching eye in largest specimen, further in the smaller ones. Eye equals snout, 4 in head. Supplemental bone a crescent. Gill-rakers much as in *williamsoni*. Dorsals and anal shorter and higher than in *williamsoni*. Scales large, dull silvery; the spots of the young not so conspicuous as in those of *williamsoni*. Length of largest specimen to origin of dorsal, 68 mm. (Plate 6.)

42. Oncorhynchus tschawytscha Walbaum. Golden, 11 specimens, the largest 120 mm. Revelstoke, a large number of specimens, the largest 120 mm. La Grande, 1 specimen. Mission, the largest 95 mm. Kamloops, 1 specimen.

43. Salmo mykiss Walbaum. Calgary, Banff, Griffin Lake, Sicamous, Kamloops, Idaho Falls, and Craig? The specimens from Calgary and Banff resemble very closely specimens in the collections of the Indiana University from the Rio Grande at Del Norte, Colorado. In one of the Rio Grande specimens I count 181 rows of scales; Dr. Jordan counted 155 to 160 in those he examined. In one of the Calgary specimens I find 156 rows. In the shape of the head and in color the specimens from Calgary and Banff are almost exact reproductions of the Rio Grande specimens. I therefore see no reason why the two should go under different names. The question of the number of species of trout does not appear settled as yet, nor is it probable that it will be until all the trout are caught. Specimens from Kamloops differ from those from Calgary in having slightly larger spots. Those from Griffin Lake have still larger and more numerous spots.

44. Thymallus signifer ontariensis Valenciennes. A single specimen, 212 mm. long; D. 21; A. 12; scales, 91. Craig, Montana. This specimen differs from the specimens obtained by Jordan in the Madison River and at Horsethief Springs, in the larger scales, being in this respect identical with the typical *signifer*, and in having the black spots extend quite to below the soft dorsal fin. The color of the dorsal is as described by Jordan.*

45. Salvelinus namaycush (Walbaum). Calgary, Banff, Devils Lake, Golden, and Revelstoke. A species of *Salvelinus*, probably to be referred to this species, reaches a large size, a meter and more in Devils Lake, in the Canadian Rocky Mountains Park. A photograph of one of these larger individuals shows it to be everywhere profusely spotted on head, sides, and back. The spots are slightly larger on lower parts of sides. Those of the head do not differ from those of the body. The dorsal, caudal, and to some extent the anal, ventrals, and pectorals, are also profusely spotted. The largest specimen obtained measures about 435 mm. The spots are much less numerous than in the photograph and those of the head show a tendency to unite, leaving a dark reticulation as a background. Dorsal, soft dorsal, and caudal well spotted; anal and inner surfaces of ventrals and pectorals also spotted. The anal margined in front and above with white. In this larger specimen the teeth of shaft of vomer are well developed.

In the Bow, into which Devils Lake has an outlet, and in the Elbow there are numerous small trout which are considered distinct from those in the lake. The largest of those obtained at Banff measured 300 mm. in length, the rest from Calgary are all smaller. In this largest specimen and in all the smaller ones no teeth are developed on the shaft of the vomer. In a specimen about 300 mm. long, from Lake Michigan, the shaft of the vomer has well-developed teeth. This would lend color to the popular belief that those of the river are different from those of the lake. The river specimens have smaller and much fewer spots, the dorsals and caudal and inner surface of pectorals are dusky without indications of spots; there are few or no spots on the head. A specimen 165 mm. long has these characters still more empha-

* Bull. U. S. Fish Com., IX, 50, pl. VIII, fig. 7.

sized. There seems to be nothing about these specimens that may not be taken as characters of the young. Other specimens from the Columbia at Golden and at Revelstoke show no differences from those from Calgary and Banff. A large head in the University's collections from 20 miles east of New Westminster, B. C., has teeth on the shaft of the vomer and is *S. namaycush* (Walbaum).

46. Percopsis guttatus Agassiz. Winnipeg, Brandon, Regina, Swift Current, Medicine Hat. This species is abundant in almost all streams from Winnipeg to Medicine Hat. They are more numerous and larger in the cool, clear streams. The genera of *Percopsidæ* may be distinguished as follows: (Plate 6.)

a. Dorsal, with two feeble, slender, unbranched rays; anal, with a single similar ray; scales most strongly ctenoid on caudal peduncle; posterior margin of preopercle entire or with feeble crenulations; form slender .... PERCOPSIS.

aa. Dorsal and anal each with two very strong spines; scales most strongly ctenoid on anterior part of body; posterior margin of preopercle with a few short but strong spines; form heavy, deep .... COLUMBIA.

47. Columbia transmontana Eigenmann & Eigenmann. Umatilla. (Plate 6.)

Columbia transmontana Eigenmann & Eigenmann, Science, 1892, 233 (Umatilla, Oregon).

Head, $3\frac{1}{3}$–$3\frac{1}{2}$ (3 in the young); depth, $3\frac{1}{2}$–$3\frac{2}{3}$ (4 in the young); D. II, $9\frac{1}{2}$; A. II, $6\frac{1}{2}$; scales, 7 to 9-44 to 46-7. Body comparatively deep, dorsal profile more arched than the ventral, making an angle at the origin of the dorsal fin; sides compressed, caudal peduncle most so. Head short and chubby, eye equal to snout, about $3\frac{1}{4}$ in the head. First dorsal spine about equal to the pupil, second spine one-half length of head, recurved and very deeply grooved behind. Anal spines somewhat lower than the dorsal spines; ventrals reaching past vent. Nape, with the exception of occipital spine, scaled. Translucent in life. Color, generally smutty. Side with three rows of more or less oblong blackish spots, the middle and superior rows most noticeable. Back with a series of similar spots, one being more conspicuous at beginning and end of first dorsal. Dorsal mottled, caudal barred. Head smutty, a blue black spot on middle of opercle; a narrow, silvery, lateral band. Young translucent, with well-defined dark spots.

48. Lucius lucius Linnæus. Winnipeg, Brandon, Westbourne, Moose Jaw, Swift Current, Medicine Hat. This species is common throughout the North and is one of the most prominent game fishes. Usually called pike, the name pickerel being applied to the two species of *Stizostedion.*

49. Pygosteus pungitius Linnæus. This species was obtained in the clear waters of the Qu'Appelle River. It was not noticed elsewhere.

50. Eucalia inconstans Kirtland. Qu'Appelle, Regina, Swift Current, Maple Creek, Calgary, Poplar. This species is very abundant at Regina just below the dam.

51. Etheostoma güntheri Eigenmann & Eigenmann.

Etheostoma güntheri Eigenmann & Eigenmann, Am. Nat. 962, 1892. Winnipeg; Cedar Rapids, Iowa.

Types: Three specimens 50, 50, and 60 mm. long, Winnipeg, Manitoba.

Three specimens from near Cedar Rapids, Iowa, collected by Seth E. Meek.

Premaxillaries not protractile; gill-membranes scarcely connected; ventral line with the median scales enlarged; lateral line complete; palate with well-developed teeth; dorsal spines, 10; preopercle entire; nape and breast, except the median line, naked; cheeks and opercles each with about three series of large ctenoid scales. This species is very closely related to *E. aspro*, from which it differs in the uniform size of the scales on the cheeks and on the opercles, etc. Head, $3\frac{4}{5}$; depth, $6\frac{1}{3}$; D. X-13 or 14; A. II, $9\frac{1}{2}$–$11\frac{1}{2}$; scales, 5-52 to 54-5. Form of *E. aspro*; mouth moderate, the maxillary not extending beyond anterior margin of eye, about 3 in head; eye, $3\frac{2}{3}$ in head; cheeks with about 25 large, strongly ctenoid scales; opercle with similar scales; gill-membranes much more connected than in *E. aspro*, the connection not extending back beyond middle of cheeks. Outer series of teeth considerably enlarged in each jaw. Dorsal spines slender and high, slightly more than snout and eye in length; soft dorsal shorter and lower than the spinous. First anal spine but little longer than second; pectoral equals head less opercular spine; ventrals but little shorter than pectorals. Breast naked, a few scales along its median line, mid-ventral line naked, the scales when present probably little if any larger than those of the sides; nape naked, as in *E. aspro.*

Translucent in life; a dark stripe down and another down and forward from eyes. A black spot on humeral region. Sides with about eight dark spots, which are narrow, on anterior part of body, further apart and larger on tail; only the last three extending above the

lateral line; ventral surface plain; back tessellated, but much less regularly and distinctly than in *E. aspro*. Spinous dorsal with a black spot between the first two or three spines and another between the bases of the last three. The remainder of the fin, as well as the soft dorsal, regularly dotted; caudal faintly barred, a black spot at its base, the remaining fins plain.

A fourth specimen from Winnipeg may belong to the same species, but it is probably an immature specimen of *E. aspro*. It is but 19 mm. long. It has D. IX-11; A. 11, 7; scales about 46. Premaxillary not protractile; gill-membranes united to below middle of cheeks; nape, cheeks, and opercles naked; breast and ventral line naked. A black stripe forward from eye, not below it; a series of ten black spots along the sides; a series of six larger ones on the back; a black band through middle of spinous dorsal; about three oblique bands on soft dorsal and on the caudal. A black spot on base of caudal. No distinguishable lateral line.

The three specimens from Iowa differ in no essentials from the Winnipeg specimens. In the smallest (40 mm.) the blotches of the sides are larger and fewer in number, and there are rather broad dorsal blotches, intermediate in position to the lateral ones.

52. Etheostoma aspro (Cope & Jordan). Four small specimens of this species were taken at Winnipeg and a number at Brandon, the largest of which is 70 mm. long. These do not differ in any essentials from specimens collected by Prof. S. E. Meek in Iowa.

53. Etheostoma nigrum Rafinesque. Specimens of this species taken at Westbourne, a tributary of Lake Winnipeg, in the Assiniboine at Brandon, and in the Qu'Appelle do not differ from specimens collected in Indiana and Iowa. I was informed by a half-breed that this species was very abundant in some small streams north of Qu'Appelle. The same information was given me by others at Brandon.

54. Etheostoma iowæ Jordan & Meek. Abundant at Swift Current. This is a very beautifully colored darter in life. The male has the base of the spinous dorsal dark blue, above which is a rusty band and then a narrower dark margin. A bright light-green spot above pectoral. Sides with about nine dark-green spots, the interspaces silvery with rusty and with green spots. Fins of the female nearly plain, the rusty spots of the sides wanting. In the alcoholic specimens the patterns of color are seen to be very varying. In smaller specimens there are about nine quite regular bands; in larger specimens the sides become much mottled by the addition of dark spots in the interspaces. Frequently there are eight or nine quadrate spots on the back. In one specimen there is a dark band along the sides from the head to the tail. The caudal is always more or less conspicuously barred, the soft dorsal less so, and the lower fins including the pectorals are plain. The lateral line is usually developed on more scales than in *E. quappelle*.

55. Etheostoma quappelle Eigenmann & Eigenmann.

Etheostoma quappelle Eigenmann & Eigenmann, Am. Nat. 963, 1892. Qu'Appelle.

Fort Qu'Appelle. A single specimen, 43 mm. This is the northernmost point at which darters have as yet been taken. Premaxillaries not protractile; gill-membranes scarcely connected; ventral line with the median scales not enlarged; lateral line straight, developed on 19 scales; palate without teeth; dorsal spines, 9; anal fin considerably smaller than soft dorsal; humeral region without black process; cheeks with a few small scales just below and behind eyes; opercle with a few scales on its upper angle. This species is closely related to *E. iowæ* and *E. jessiæ*, differing in the radial formula, scales, etc. In shape it approaches very nearly *E. iowæ*, being much slenderer than *jessiæ*. Head, 4; depth, 5½; D. IX-9; A. 11, 6½. Scales, 3-53-7; lateral line developed on 19 scales. Form similar to *E. iowæ*, its dorsal profile notably less arched, its head lower and less compressed, more truly conic. Snout rather blunt, the maxillary extending to anterior margin of pupil, about 3 in head. Eye moderate, 3½ in head. Teeth in very narrow bands, the outer series enlarged. Cheeks with about 10 small cycloid scales bordering the lower posterior portion of orbit; opercles with a few scales. Dorsal spines rather short and stiff, the highest equal to snout and orbit. Second dorsal shorter than first, base of anal much shorter than base of second dorsal, not equal to snout and eye. Pectoral and ventrals about equal in length, about equal to head less opercle. Nape and breast naked; mid-ventral line with small scales. General color dusky, the markings much less conspicuous than in *iowæ*. A dark shade downward from eye, another forward; a black spot behind eye; a dusky region on opercle and on shoulders. Sides with about 8 dark blue bars, alternating with rusty bars, the margins of these ill defined. No blotches on back. Basal half of spinous dorsal black, the remainder hyaline. Soft dorsal and caudal barred, anal and ventrals hyaline, pectorals dusky.

56. **Perca flavescens** Mitchill. Abundant at Fort Qu'Appelle; Brandon.

57. **Stizostedion vitreum** (Mitchill). Winnipeg, Moose Jaw, Fort Qu'Appelle. A single specimen from Moose Jaw has the sides and upper parts all quite dark with few yellow spots in streaks. Spinous dorsal dusky with the usual black spots. Soft dorsal, caudal, and pectoral colored like the sides; anal and ventrals yellow with many dark spots. D. xv-1, 21.

58. **Stizostedion canadense griseum** DeKay. Winnipeg, Brandon, Poplar.

59. **Aplodinotus grunniens** Rafinesque. Winnipeg, abundant.

60. **Cottus asper** (Richardson). Mission, Sicamous, Kamloops, Griffin Lake, and Umatilla. Very abundant in the Fraser system from tidewater to an altitude of 1,900 feet. This species varies greatly in color in different localities. At Mission I obtained a number in the turbid water of the Fraser. These are gray with the usual dark markings; I obtained two specimens from a little brook of clear water which were very much darker, the gray remaining as but narrow streaks and spots among the general ground color of black both on the sides and fins.

61. **Cottus bairdi punctulatus** Gill. Craig, Montana.

62. **Cottus rhotheus** (R. Smith). Two fine specimens of this species, 120 mm long, and a number of smaller ones were obtained at La Grande. Lateral line complete. D. VII or VIII, 17; A. $12\frac{1}{2}$ or $13\frac{1}{2}$. Soft dorsal adnate behind, the membrane extending to near caudal. Color of largest specimens: soft dorsal with oblique bars, most marked on the rays; caudal with about three large bars. The species is quite common at Idaho Falls.

63. **Cottus philonips** Eigenmann & Eigenmann.

Cottus philonips Eigenmann & Eigenmann, Am. Nat. 963, 1892. Field.

Seventeen specimens of a *Cottus* were taken in the icy waters of the Kicking Horse at Field, B. C. Head, about $4\frac{3}{4}$–4 in head. D. VIII or IX-16 to 18; A. II, 13; V. I, 4. Pectoral reaching anal or past vent even in largest specimens. Anal equidistant from tip of snout and base of caudal or nearer tip of snout. Ashy gray with blackish blotches. No well-defined crossbars except sometimes near the tail. Frequently a dusky blotch on anterior part of spinous dorsal and another near its posterior end; the fin sometimes wholly dusky, margined with white. Pectorals, soft dorsal, and caudal more or less barred.

64. **Cottus onychus** Eigenmann & Eigenmann.

Cottus onychus Eigenmann & Eigenmann, Am. Nat., 963, 1892. Calgary.

A single specimen 82 mm. long from Calgary. This species is evidently closely related to *C. pollicaris* (J. & G.), from which it differs chiefly in having many prickles. Head, $3\frac{3}{4}$; depth, $5\frac{1}{2}$; D. VIII, 17; A. 13; ventrals, I, 4; pectorals, 13. Teeth on vomer, none on palatines. Width of head equals its length to end of preopercular spine, its depth 2 in its length. Preopercle with an upturned claw-like spine, below which are two others, much smaller, the anterior one having its point turned downward and forward. Eye $1\frac{1}{3}$ in snout, $\frac{1}{2}$ in interorbital, 5 in head. Maxillary not reaching orbit. Sides above the lateral line, which is complete, with stiff prickles from below first spine to below the last dorsal ray; prickles below the lateral line confined to the abdominal part of the sides. Dorsals connected by a low membrane, the rays much higher than the spines, $3\frac{1}{2}$ in head. Pectorals reaching past vent, its rays not branched. A dusky spot on breast just behind anterior end of gill-slits; ventral surface, including the ventrals, otherwise plain. Anal with a few dusky specks on its rays; other fins barred; sides and upper surfaces olive with darker spots. Three dark bands below soft dorsal; a dark band just in front of the caudal.

65. **Lota lota maculosa** (LeSueur). Winnipeg, Craig. Abundant at Winnipeg. A single specimen was taken in the Missouri with hook and line. This species was reported to me at Calgary, where it is said to ascend the streams south of Calgary in great numbers. A species of "ling" was also reported to me at Golden* and again at Sicamous. From the description given it must be closely related to the species under consideration. It is said to reach a length of 1.50 m. At Sicamous they had this species for dinner just before I arrived, which is the nearest I came to securing it on the Pacific slope.

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*I have recently received a specimen from this place through Mr. Green. It is identical with the Atlantic slope form.

Table showing the distribution of the different species collected.

Species.	Red River Basin.						Saskatchewan.						Columbia.			Fraser.				Columbia.				Missouri.	
	Winnipeg.	Westbourne.	Brandon.	Qu'Appelle.	Regina.	Moose Jaw.	Chaplin.	Swift Current.	Maple Creek.	Medicine Hat.	Calgary.	Banff.	Field.	Golden.	Revelstoke.	Griffin Lake.	Sicamous.	Kamloops.	Mission.	Umatilla.	La Grande.	Caldwell.	Idaho Falls.	Craig.	Poplar.
Ammocœtes tridentatus																					+	+			
Acipenser sturio	+		?																						
Acipenser transmontanus																			??	??					
Acipenser medirostris																			??	??					
Scaphirhynchus platyrhynchus	?																								
Noturus flavus																								+	
Ictalurus punctatus			?							?															
Ictiobus cyprinella	+																								
Carpiodes velifer			+							+															+
Catostomus catostomus	+							+		+	+	+		+	+										
Catostomus griseus								+																+	
Catostomus macrocheilus																?	+	+		+	+	+	+		
Catostomus commersoni	+	+		+	+	+		+	+	+	+														+
Pantosteus jordani																						+			
Moxostoma aureolum	+	+	+																						+
Moxostoma anisurum	+		+																						
Hybognathus placita																									+
Acrocheilus alutaceus																				+		+			
Pimephales promelas	+	+	+	+	+			+	+	+															
Notropis jordani										+															
Notropis heterolepis				+																					
Notropis reticulatus			+	+																					
Notropis deliciosus	+																								
Notropis megalops			+																						
Notropis scopiferus	+		+							+															
Notropis jejunus	+		+							+															
Notropis atherinoides	+									+															+
Rhinichthys dulcis			?					+		+	+	+												+	+
Agosia nubila																							+		
Agosia falcata																				+		+			
Agosia falcata shuswap																	+								
Hybopsis storerianus	+																								
Couesius dissimilis								+		+	+														+
Platygobio gracilis			+							+														+	+
Mylocheilus caurinus														+	+		+	+	+	+					
Ptychocheilus oregonensis																	+	+		+	+	+			
Leuciscus atrarius																							+		
Leuciscus hydrophlox																							+		
Leuciscus balteatus														??	??						?				
Leuciscus balteatus lateralis														+	+	+	+	+		+		+			
Hiodon alosoides	+		+							?															+
Hiodon tergisus	+		+																						
Coregonus williamsoni											+	+		+	+		+			+	+	+	+	+	
Coregonus coulteri													+	+											
Coregonus clupeiformis				?																					
Coregonus tullibee	?			?																					
Salmo mykiss											+	+				+	+	+					+	?	
Thymallus signifer ontariensis																								+	
Salvelinus namaycush	?										+	+		+	+										
Oncorhynchus tschawytscha														+	+						+				
Percopsis guttatus	+		+		+			+		+															
Columbia transmontana																				+					
Lucius lucius	+	+	+		?	+		+		+															
Pygosteus pungitius				+																					
Eucalia inconstans				+	+			+	+		+														+
Etheostoma güntheri	+																								
Etheostoma aspro	+		+																						
Etheostoma nigrum		+	+	+																					
Etheostoma iowæ								+																	
Etheostoma quappelle				+																					
Perca flavescens			+	+																					
Stizostedion canadense griseum	+	?	+							?															+
Stizostedion vitreum	+			+		+				?															
Aplodinotus grunniens	+																								
Cottus asper																+	+	+	+	+					
Cottus bairdi punctulatus																								+	
Cottus rhotheus																					+		+		
Cottus philonips													+												
Cottus onychus																									
Lota lota maculosa	+									?	?			+	?		?							+	+
Totals	24	5	17	11	4	3	...	10	3	14	9	5	2	8	6	3	8	8	4	9	7	8	7	8	11

Interrogation marks in the table signify that the species are probably found at the localities indicated, but were **not** taken by me.

OBSERVATIONS ON THE DISTRIBUTION OF THE SPECIES OBTAINED AND THE RELATION OF THE DIFFERENT RIVER FAUNÆ EXAMINED TO EACH OTHER.

Six of the sixty-five species obtained are found on both the east and west slope of the continent, *Pantosteus jordani*, *Coregonus williamsoni*, *Salmo mykiss*, *Catostomus catostomus*, *Salvelinus namaycush*, *Lota maculosa*. (*Rhinichthys dulcis* is recorded from the Pacific Slope. I obtained none.)

Forty-two species were found in the Winnipeg system. They are:

Acipenser sturio.	Notropis megalops.	Lucius lucius.
Ictalurus punctatus.	Notropis scopiferus.	Pygosteus pungitius.
Ictiobus cyprinella.	Notropis jejunus.	Eucalia inconstans.
Carpiodes velifer.	Notropis atherinoides.	Etheostoma güntheri.
Catostomus catostomus.	Rhinichthys dulcis.	Etheostoma aspro.
Catostomus griseus.	Hybopsis storerianus.	Etheostoma nigrum.
Catostomus commersoni.	Couesius dissimilis.	Etheostoma iowæ.
Moxostoma aureolum.	Platygobio gracilis.	Etheostoma quappelle.
Moxostoma anisurum.	Hiodon alosoides.	Perca flavescens.
Pimephales promelas.	Hiodon tergisus.	Stizostedion canadense griseum.
Notropis jordani.	Coregonus williamsoni.	Stizostedion vitreum.
Notropis heterolepis.	Salmo mykiss.	Aplodinotus grunniens.
Notropis reticulatus.	Salvelinus namaycush.	Cottus onychus.
Notropis deliciosus.	Percopsis guttatus.	Lota lota maculosa.

Eight of these species were found in the Saskatchewan and not in the Red River. They are:

Catostomus griseus.	Couesius dissimilis.	Etheostoma iowæ.
Notropis jordani.	Coregonus williamsoni.	Cottus onychus.
Rhinichthys dulcis.	Salmo mykiss.	

Sixteen species were taken in the Red River of the North and not in the Saskatchewan. Many of these will probably be found in the Saskatchewan when its lower waters are examined:

Acipenser sturio.	Notropis deliciosus.	Etheostoma aspro.
Ictiobus cyprinella.	Notropis megalops.	Etheostoma nigrum.
Moxostoma aureolum.	Hybopsis storerianus.	Etheostoma quappelle.
Moxostoma anisurum.	Pygosteus pungitius.	Perca flavescens.
Notropis heterolepis.	Etheostoma güntheri.	Aplodinotus grunniens.
Notropis reticulatus.		

The seventeen species taken in the Missouri are as follows:

Noturus flavus.*	Notropis atherinoides.	Thymallus signifer ontariensis.*
Carpiodes velifer.	Rhinichthys dulcis.	Eucalia inconstans.
Catostomus griseus.	Couesius dissimilis.	Stizostedion canadense griseum.
Catostomus commersoni.	Platygobio gracilis.	Cottus bairdi punctulatus.*
Moxostoma aureolum.	Hiodon alosoides.	Lota lota maculosa.
Hybognathus placita.*	Coregonus williamsoni.	

Of these, but two species (*Rhinichthys dulcis* and *Platygobio gracilis*) are found both at Poplar and at Craig. Thirteen of the species taken in the Missouri are found in the Saskatchewan basin.

The species of the Saskatchewan, with the exception of the new species, have all been taken in the Mississippi basin. The Saskatchewan basin, therefore, can not be separated from the Mississippi basin by any positive characters.

* Not found in the Winnipeg system.

The families of the Mississippi basin not yet found in the Saskatchewan basin are:

1. Lepisosteidæ.
2. Amiidae.
3. Clupeidæ.
4. Dorosomidæ.
5. Amblyopsidæ.
6. Cyprinodontidæ.
7. Umbridæ.
8. Anguillidæ.
9. Atherinidæ.
10. Aphredoderidæ.
11. Serranidæ.

Twenty two specimens were taken in the Columbia. They are:

Ammocœtes tridentatus.
Catostomus catostomus.
Catostomus macrocheilus.
Pantosteus jordani.
Acrocheilus alutaceus.
Agosia nubila.
Agosia falcata.
Mylocheilus caurinus.
Ptychocheilus oregonensis.
Leuciscus atrarius.
Leuciscus hydrophlox.
Leuciscus balteatus lateralis.
Coregonus williamsoni.
Coregonus coulteri.
Salmo mykiss.
Salvelinus namaycush.
Oncorhynchus tschawytscha.
Columbia transmontana.
Cottus asper.
Cottus rhotheus.
Cottus philonips.
Lota lota maculosa.

The ten species taken in the Fraser system are:

Catostomus macrocheilus.
Agosia falcata shuswap.
Mylocheilus caurinus.
Ptychocheilus oregonensis.
Leuciscus balteatus.
Leuciscus balteatus lateralis
Coregonus williamsoni.
Salmo mykiss.
Oncorhynchus tschawytscha.
Cottus asper.

But one variety, *Agosia falcata shuswap*, was found in the Fraser that was not also found in the Columbia. (*Leuciscus balteatus* has been taken by others in the Columbia system.)

Several species of *Oncorhynchus* and *Acipenser* are known from the Columbia and from the Fraser which are not included in these numbers.

STRUCTURAL PECULIARITIES OF THE FRESH-WATER FISHES OF THE PACIFIC SLOPE.

Almost every family of fishes having representatives in the fresh waters of both the Atlantic and the Pacific slopes has one or more of its Pacific slope representatives modified in one or the other of two directions: There is either a larger number of rays or spines in one or more of the fins, or some of the rays have become modified into spines. The largest number of either dorsal or anal rays is almost always found in some Pacific slope species, and the range of variation is always greater in the Pacific slope species than in the Atlantic slope species of the same family, although the number of species is usually less. In most cases the differences are just perceptible, and, were it not for the consensus of differences in all groups they would stand for nothing. The most marked differences are found in those fishes which are generically distinct from their Atlantic slope relatives. In several cases these modifications themselves, aside from all others, are of generic importance, as in the genera *Archoplites*, *Meda*, *Lepidomeda*, *Columbia*, and the subgenus *Richardsonius*.

The modifications of the same set of organs being practically of the same nature, are unquestionably due to one definite cause. What that cause is I am at present unable to say. A comparatively short swift water-course, as most of the Pacific rivers have, suggests itself at once, but, as will be seen under the head of "Local

The *Petromyzontidæ* and *Centrarchidæ* were not secured by me, but Mr. A. J. Woolman found these families in the headwaters of the Red River system.

variations," the number of rays in these streams decreases with the altitude and swiftness of the stream. Moreover, the Pacific streams of South America have still shorter and presumably still swifter streams, and no such modifications are seen in the fishes inhabiting these waters.

The most striking case, that of *Leuciscus* (*Richardsonius*) is explained more fully in the chapter on local variations. In the subgenus *Richardsonius*, confined to the Columbia and to the Fraser systems, the number of anal rays varies from 12 to 25, an increase of from 2 to 15 rays over *Leuciscus*, some of whose species have also reached the headwaters of the Columbia, but whose usual habitat is the Atlantic slope. The genus *Oncorhynchus* has a similar increase of anal rays over *Salmo* and *Salvelinus*, which are genera of wider distribution, some of the species being found on the Atlantic, some on the Pacific, and some on both slopes. On the other hand *Thymallus* has a larger number of dorsal rays than any Pacific slope species.

The change from rays to spines is seen in *Archoplites*, *Meda*, etc. It is most strikingly marked in the change from *Percopsis* to *Columbia*, the only known genera of the *Percopsidæ*. The former is confined to the Atlantic, the latter to the Pacific slope. In the former, feeble unsegmented rays at the beginning of the dorsal and of the anal are developed into strong spines in the latter. Long ago Prof. Cope* noticed a similar modification as to spines in *Meda*. Prof. Cope says:

> As one of the most valuable results derived from a study of the collections, it appears that the basin of the Colorado River is the habitat of a small group of fishes of the family *Cyprinidæ*, which may be called the *Plagopterinæ*, which embraces three genera—*Plagopterus* Cope, *Lepidomeda* Cope, and *Meda* Girard. The group differs from others of the family in the possession of two strong osseous rays of the dorsal fin, the posterior of which is let into a groove in the hinder face of the anterior without being coössified with it, thus constituting a compound defensive spine. The rays of the ventral fin, excepting the first and second, are similarly modified. The greater part of their length consists of an osseous dagger-shaped spine, with grooved posterior edge, which overlaps the border of the succeeding ray, when the fin, like a fan, is closed up. The articulated portion of the ray either emerges from the groove below the free acute apex of the spine, or appears as a continuation of the apex itself. * * * Interest attaches to the *Plagopterinæ* as the only type of fishes not known from other waters than those of the Colorado and San Luis basins.

An interesting condition is seen in *Hysterocarpus*, the only fresh-water genus of the *Embiotocidæ*. It is confined to the Sacramento Basin and has 16 to 18 dorsal spines, as compared with 8 to 11 in the many marine genera. Unfortunately this is the only available example of the change from salt to fresh water.

I give here a detailed comparison of the rays of the Pacific fishes as compared with their Atlantic relatives, from which it will be seen, as stated above, that in every family the modification is noticeable, although in many cases it is minute. As far as possible the western and eastern representatives of the same forms are placed opposite to each other.

ACIPENSERIDÆ.

Species	Pacific slope.		Species.	Atlantic slope.	
	Dorsal.	Anal.		Dorsal.	Anal.
Acipenser transmontanus	44–48	28–30	Acipenser sturio	38	27
Acipenser medirostris	33–35	22–28	Acipenser rubicundus	35	26
			Acipenser brevirostris	41	22

* Cope & Yarrow, Wheeler's Surveys, chapter VI, Report upon the Collections of Fishes made in portions of Nevada, Utah, California, Colorado, New Mexico, and Arizona.

CATOSTOMIDÆ.

Ictiobinæ.

[Lowland species which have not been able to cross the Rocky Mountains.]

Species.	Pacific slope. Dorsal.	Pacific slope. Anal.	Species.	Atlantic slope. Dorsal.	Atlantic slope. Anal.
Not represented on Pacific slope.	....	....	Ictiobus	24-30	7-10
			Cycleptus	30	7-8

Catostominæ.

Species.	Pacific slope. Dorsal.	Pacific slope. Anal.	Species.	Atlantic slope. Dorsal.	Atlantic slope. Anal.
Pantosteus	10-12	....	Pantosteus	9-12	....
Catostomus	10-15	....	Catostomus	11-12	....
Xyrauchen	12-15	....	Hypentelium	10-11	....
Chasmistes	11-12	....	Erimyzon	10-13	....
			Minytrema	12	....

Moxostominæ.

Species.	Pacific slope. Dorsal.	Pacific slope. Anal.	Species.	Atlantic slope. Dorsal.	Atlantic slope. Anal.
Not represented on Pacific slope.	....	....	Moxostoma	12-15	....
			Placopharynx	13	....
			Quassilabia	12	....

The *Catostominæ* present one of the cases which, if found alone, would not bear evidence either in one or the other direction. The average number of rays is slightly larger on the Pacific side and the highest number of rays is also found on the Pacific slope. The *Ictiobinæ* and *Moxostominæ* are not represented on the Pacific slope.

CYPRINIDÆ.

[The species showing an increased number of rays on either slope are in italic.]

Genera.	Pacific slope. Dorsal.	Pacific slope. Anal.	Genera.	Atlantic slope. Dorsal.	Atlantic slope. Anal.
Acrocheilus	10	9	Campostoma	8	7-8
Orthodon	9	8			
Lavinia	10	12			
			Chrosomus	7-8	8
			Oxygeneum	8	7
			Hybognathus	8	7-8
			Pimephales	[illegible], 8	8
			Exoglossum	8	7
			Cochlognathus	8	6-7
Tiaroga	8	7	Cliola	8	7
			Notropis	8 or 9	* 7-14
			Erizymba	8	8
Rhinichthys	8	7	Phenacobius	8	7
Agosia	8 or 9	7	Rhinichthys	8	7
Hybopsis	8	7-8			
			Hybopsis	8	8
			Couesius	8	7-8
Pogonichthys	9	8	Platygobio	8	8
Mylocheilus	8	8	Semotilus	7 or 8	7-8
Mylopharodon	8	8			
Ptychocheilus	8 or 9	8-9			
Gila	9-10	9-10			
Leuciscus.					
(*Richardsonius*) †	8	10-22	Leuciscus.		
(Tigoma)	8	8	(*Clinostomus*)	8-9	8-9
(*Squalius*)	8	8-10	(*Tigoma*)	8-9	8
(*Cheonda*)	9	7-10	(*Squalius*)	9	8
Myloleucus	8-9	7-8	(Cheonda)	8	7
			Myloleucus	8	8
			Opsopœodus	9	8
Luxulinus	10-11	11	Hemitremia	8	8
Lepidomeda	II, 7	9	*Notemigonus*	8-10	9-14
Meda	II, 7	8-10			

* 14 in one species, usually 7-9, in a few 10-12. † In this count the two rudimentary spines are omitted.

SALMONIDÆ.

Genera.	Pacific slope.		Genera.	Atlantic slope.	
	Dorsal.	Anal.		Dorsal.	Anal.
Oncorhynchus	9–11	13–17	Salmo	11–12	10
Salmo	11–12	10–12	Salvelinus	10–13	9–11
Salvelinus	11	9–11	Thymallus*	20	11

* *Thymallus* is probably an European element in the Eastern fauna

CYPRINODONTIDÆ.

This family of about fifty species is represented on the Pacific slope by but four species. Many of the forms are marine and only occasionally enter fresh water. To this class belongs the only species of *Fundulus* found on the Pacific slope. Leaving this out of consideration, we have *Cyprinodon baileyi* from the Pacific slope, with two more anal rays than any other *Cyprinodon*, but with two less than the highest number in *Fundulus*, and *Empetrichthys* with anal rays equal to the highest in the family:

Genera.	Pacific slope.		Genera.	Atlantic slope.	
	Dorsal.	Anal.		Dorsal.	Anal.
			Jordanella	I, 16–17	I, 11–13
Cyprinodon	10	10–13	Cyprinodon	10–12	10–11
Fundulus	13	11	Fundulus	10–17	8–15
			Zygonectes	7–11	8–14
			Lucania	9–13	9–11
			Gambusia	6–9	7–11
			Mollienesia	13	7
			Pœcilia	7	4
Girardinus	7	9	Girardinus	7	9
Empetrichthys	11–13	13–15			

GASTEROSTEIDÆ.

The species of those genera of *Gasterosteidæ* having representatives on both slopes are given in detail:

Species.	Pacific slope.		Species.	Atlantic slope.	
	Dorsal.	Anal.		Dorsal.	Anal.
Pygosteus brachypoda	X, I, 10	I, 10	Pygosteus pungitius	VII to IX-I, 9	I, 9
G. cataphractus	III, 11–13	I, 9 or 10	Gasterosteus aculeatus	III, 11 to 13	I, 9 or 10
G. microcephalus	III, 11–13	I, 9	G. atkinsii	III, 11	I, 8
G. williamsoni	IIII, 10	I, 7	G. wheatlandi	III, 10–12	I, 8
			G. dimidiatus	III, 12	I, 8
			Eucalia inconstans	IV, 1–10	I, 10
			Apeltes quadracus	III, I, 11	I, 8

In *Pygosteus brachypoda* we have an increase of one spine over the maximum number in Atlantic specimens (*Pygosteus pungitius*). In the genus *Gasterosteus* no influence is evident except in *G. williamsoni*, in which there is an increase of one dorsal spine.

CENTRARCHIDÆ.

The family *Centrarchidæ* offers an apparent exception, since some of the genera of this family have much longer fins than the only Pacific slope representative, as indicated by the following table:

Atlantic slope genera without representatives on the Pacific slope.

Genera.	Dorsal.	Anal.
Centrarchus	XI or XII, 12	VII or VIII, 15.
Pomoxis	VI–VIII, 15	VI, 18.
Chænobryttus	X, 9 or 10	III, 8 or 9.
Acantharchus	XI, 10	V, 10.
Enneacanthus	IX or X, 9–11	III–IV, 8–10.
Mesogonistius	X, 10	III, 12.
Lepomis	X, 10–12	III, 9–11.
Micropterus	X, 13	III, 12.

But a comparison of *Archoplites* with its nearest Atlantic slope relative gives the following interesting results:

Locality and species.	Dorsal.	Anal.
Pacific slope:		
Archoplites interruptus	XIII, 10	VII, 10
Atlantic slope:		
Ambloplites rupestris	XI, 10	VI, 10

Giving an increase of 2 spines in the dorsal and of 1 spine in the anal for the Pacific slope as compared with the nearest allied species, and an absolute gain of 1 dorsal spine over all the other genera of this family. As the comparison ought obviously to be limited to those genera or closely related genera having representatives on both sides, the contrast (between *Archoplites* and *Ambloplites*) is very striking.

COTTIDÆ.

In this genus the dorsal and anal rays in different species are as follows:

Species.	Pacific slope.		Species.	Atlantic slope.	
	Dorsal.	Anal.		Dorsal.	Anal.
C. asper	VIII, IX, or X, 20.	18	C. bairdi	VII, 16, 17	12½
			C. cognatus	VIII, 18	14
C. semiscaber	VII, 18	14	C. spilotus	VIII, 17	13
C. centropomus	VIII, 17	14	C. pollicaris	VII, 19	13
C. rhotheus	VIII, 15	11	C. viscosus	VI, 18	14
C. bendirei	VIII, 16	12	C. gracilis	VIII, 16	12
C. marginatus	VIII, 18	15	C. goboides	VII, 17	12
C. philonips	VIII, 19	14	C. boleoides	VIII, 17	11
C. beldingi	VI–VIII, 15–18	12	C. franklini	VIII, 17	12
			C. formosus	VIII, 16	11
			C. hoyi	VI, 15	11
Average	VIII–, 17½	14+	Average	VII, 17	12+

SUMMARY OF THE FOREGOING COMPARISONS.

1. The Pacific *Acipenser transmontanus* has a maximum of 7 more dorsal rays than any of the Atlantic species.

2. In the *Catostomidæ*, we have the genus *Xyrauchen* with 1 to 2 more rays than any of the Atlantic genera of *Catostominæ* and the genus *Catostomus* with species having 2 more dorsal rays than any of the Atlantic species of the same genus.

3. In the *Cyprinidæ*, *Lepidomeda* and *Meda* differ from all other American species in the development of spines in the dorsal fin. The genera *Acrocheilus*, *Lavinia*, *Pogonichthys*, *Gila*, and the subgenera *Richardsonius*, *Squalius*, and *Cheonda* all have more rays than their Atlantic relatives. The greatest absolute gain in the number of rays over all Atlantic slope species amounts sometimes to 8 rays. To offset this we have only some species of *Notropis* and *Notemigonus* with rays exceeding the usual number on the Pacific slope. In this family both the modifications are found.

4. In the *Salmonidæ*, the species of the genus *Oncorhynchus* have 13 to 17 anal rays, while the highest number in the Atlantic species reaches no more than 11 rays.

Thymallus, on the other hand, has a larger number of dorsal rays than any other American salmonoid.

5. In the *Percopsidæ*, the feeble armature of *Percopsis* is changed into the strong spines of *Columbia*.

6. In the *Gasterosteidæ*, *Pygosteus brachypoda* and *Gasterosteus williamsoni* have each 1 more dorsal spine than any of their Atlantic congeners.

7. In the *Centrarchidæ* we have an absolute gain of 1 dorsal spine over all Atlantic slope genera, while the gain is 2 dorsal spines and 1 anal spine in *Archoplites* as compared with its nearest relative *Ambloplites*.

8. Finally in the *Cottidæ*, *Cottus asper* reaches a higher number of dorsal spines and rays and of anal rays than is ever reached in the numerous Atlantic slope species of this genus. The average number of dorsal spines is 1 more on the Pacific slope than on the Atlantic slope, while the average number of anal rays is higher by 2.

These data fully warrant the statement made at the beginning of this chapter that "almost every family of fishes having representatives in the fresh waters of both the Atlantic and the Pacific slopes has one or more of its representatives modified in one or the other of two directions: There is either a larger number of rays or spines in the fins, or some of the rays have become modified into spines."

EXTENT OF VARIATION BETWEEN THE PACIFIC SLOPE SPECIES OF THE DIFFERENT FAMILIES AS COMPARED WITH THE ATLANTIC SLOPE SPECIES OF THE SAME FAMILIES.

Utilizing the data contained in the detailed lists in the preceding chapter, we obtain the following:

Families having both Atlantic and Pacific Slope species.	Pacific slope.		Atlantic slope.	
	Dorsal.	Anal.	Dorsal.	Anal.
Acipenseridæ:				
Highest number of rays	48	30	41	27
Lowest number of rays	33	22	35	22
Extent of variation	15	8	6	5
Catostominæ:*				
Highest number of rays	15	....	13	....
Lowest number of rays	10	....	10	....
Extent of variation	5	....	3	....
Cyprinidæ:				
Highest number of rays	11	22	10	14
Lowest number of rays	8	7	7	6
Extent of variation	3	15	3	8
Salmonidæ:				
Highest number of rays	12	17	20	†15
Lowest number of rays	9	9	11	9
Extent of variation	3	8	9	6
Cyprinodontidæ:				
Highest number of rays	13	15	17	15
Lowest number of rays	7	7	7	7
Extent of variation	6	8	10	8

* For obvious reasons subfamilies of *Catostomidæ* not found in Pacific waters are not taken into consideration.
† Or if we leave out of consideration *Thymallus*, we obtain dorsal 13; anal 11.

In the following spiny-rayed fishes the combination of highest number of spines and rays need not occur in the same species:

Families having both Atlantic and Pacific Slope species.	Pacific slope.		Atlantic slope.	
	Dorsal.	Anal.	Dorsal.	Anal.
Gasterosteidæ:				
Pygosteus—				
Highest number of spines and rays	X, I, 10	I, 10	IX, I, 9	I, 8
Gasterosteus—				
Highest number of spines and rays	IV, 13	I, 10	III, 13	I, 10
Lowest number of spines and rays	III, 10	I, 7	III, 11	I, 8
Extent of variation	I, 3	3	2	2
Eucalia	....	....	IV, I, 10	I, 10
Apeltes (brackish water of Atlantic coast)	....	....	IV, 11	I, 8
Total extent of variation in Gasterosteidæ	VIII, 3	3	VII, 4	2
Centrarchidæ (only a single specimen found on Pacific slope).				
Cottidæ:				
Highest number of spines and rays	X, 20	18	VIII, 18	14
Lowest number of spines and rays	VII, 15	12	VI, 15	11
Extent of variation	III, 5	6	II, 3	3

We learn from these tables that in all families but the *Cyprinodontidæ* with more than one species on the Pacific slope the extent of variation is greater than in the same families on the Atlantic slope.* This might have been expected if the number of species were greater on the Pacific than on the Atlantic slope, but in most cases the reverse is true, as may be seen from the following table:

Family or subfamily.	Pacific slope.		Atlantic slope.	
	Genera.	Species.	Genera.	Species.
Acipenseridæ	1	2	2	4
Catostominæ	4	21	4	11
Cyprinidæ	17	75	21	175
Salmonidæ	3	12	4	12
Cyprinodontidæ	4	5	9	About 45
Gasterosteidæ	2	4	4	7
Centrarchidæ	1	1	9	26
Cottidæ	1	8	1	12

I can conceive of but three possible explanations for this variation:

(1) The Pacific slope fauna may be new as compared with the Atlantic. The comparatively new conditions may have thrown the characters into a condition of unstable equilibrium with the selection of the adapted forms. The fluctuations in the fin rays of some of the species would lend weight to such a supposition.

(2) The Pacific slope fauna may be of diverse origin.

(3) Both of these factors may have contributed to bring about the present condition.

This last seems to me to be the true solution. Most of the forms have undoubtedly been derived within comparatively recent time from the Atlantic slope of North America, while others have a decidedly Asiatic cast.

Acipenser and *Oncorhynchus* are certainly of Asiatic origin. While I am not sufficiently acquainted with Asiatic minnows to speak with certainty, some of the genera of minnows seem to have a decided Asiatic affinity.

Many of the *Catostominæ*, the *Cyprinidæ*, and *Salvelinus*, *Archoplites*, and probably *Cottus* have all been derived from forms from the eastern slope of North America.

* The only other exception is introduced by *Thymallus*.

LOCAL VARIATIONS.*

Since all structures differing from the average are usually confined to a definite horizon or more or less restricted region, all such differences may be considered local variations. The larger zoogeographical regions or provinces are in this extended sense localities, and the orders, families, or species are the local variations peculiar to the region or province. A somewhat more restricted definition would include such phenomena as are noticed in the peculiar modifications of the fins of Pacific slope fresh-water fish described in the previous chapter. Some *Cyprinidæ* of the Colorado basin, for instance, have the anterior dorsal rays strong and spinous, while all the Atlantic slope species have them weak and rudimentary. Another instance is the increased number of rays in the fins of Pacific slope fishes. Still another instance is offered by the *Percopsidæ*. *Columbia* has strong spines in both the dorsal and anal fins, while *Percopsis*, the Atlantic slope genus, has none.

For the present purpose I want to restrict the meaning still further. In studying the South American catfishes, I found that all the Amazonian species of the genus *Rhamdia* have 6 dorsal rays, while several of the southern forms have more. One peculiar to the La Plata has 6–9; another from the San Francisco has 10 rays. More remarkable still is the case of *Pseudopimelodus zungaro*. All the specimens taken in the Amazon have 6 dorsal rays, while of a smaller number taken further south several have 7 dorsal rays.

It is to variations like the last, *i. e.*, variations within the species or closely related species found in different localities within a restricted region, that I want to confine my present remarks. Variations within species are a matter of lines and curves, minute measurements, and shades of color: all matters difficult to keep in mind, still more so to represent to others. All naturalists are aware of the existence of slight differences peculiar to different localities, but such variations are usually but vaguely conceived by the observer, and still more vaguely by any one to whom the observer may attempt to explain them.

The past summer I collected a large series of specimens of *Leuciscus* and *Richardsonius*. These were taken in a number of different localities and in two separate river systems, the Columbia and the Fraser. The localities extend from tide water to an elevation of 1,900 feet on the Fraser, and from 300 to 4,700 feet on the Columbia system. I have also examined a number of specimens collected by Dr. Jordan in Utah. There were in all 296 specimens which I was personally able to examine. In these specimens the local variations are so well marked that a graphic method of demonstrating the variations is possible.

Before attempting to explain the charts which illustrate this matter, it is necessary to state that there have been known from the two river systems two groups or genera of *Cyprinidæ* having elongate anal fins. These were *Richardsonius* (*balteatus* and *lateralis*) and a section of *Leuciscus* (*montanus*, *hydrophlox*, and *gilli*). There are, first, variations which do away with the genus *Richardsonius*, as distinct from *Leuciscus*; second, a number of variations which, while very striking, need not be taken into consideration, because the variations in a single character are sufficient for our purposes. We shall limit the observation to the variation in the number of anal rays.

* Read at the December meeting of the Indiana Academy of Sciences, 1892.

In the American genera of *Cyprinidæ* the number of anal rays is usually fixed within two or three for any genus. In the group of fishes under consideration the number varies within 12.

Now a word as to the charts. The vertical lines on plates 7 and 8 represent the number of anal rays, beginning on the left with the lowest number observed and ending on the right with the highest. A certain height (100 mm.) is taken to represent 100 per cent. The height of the curve on each vertical line is made to represent the per cent of specimens having that particular number of rays expressed in millimeters of height.

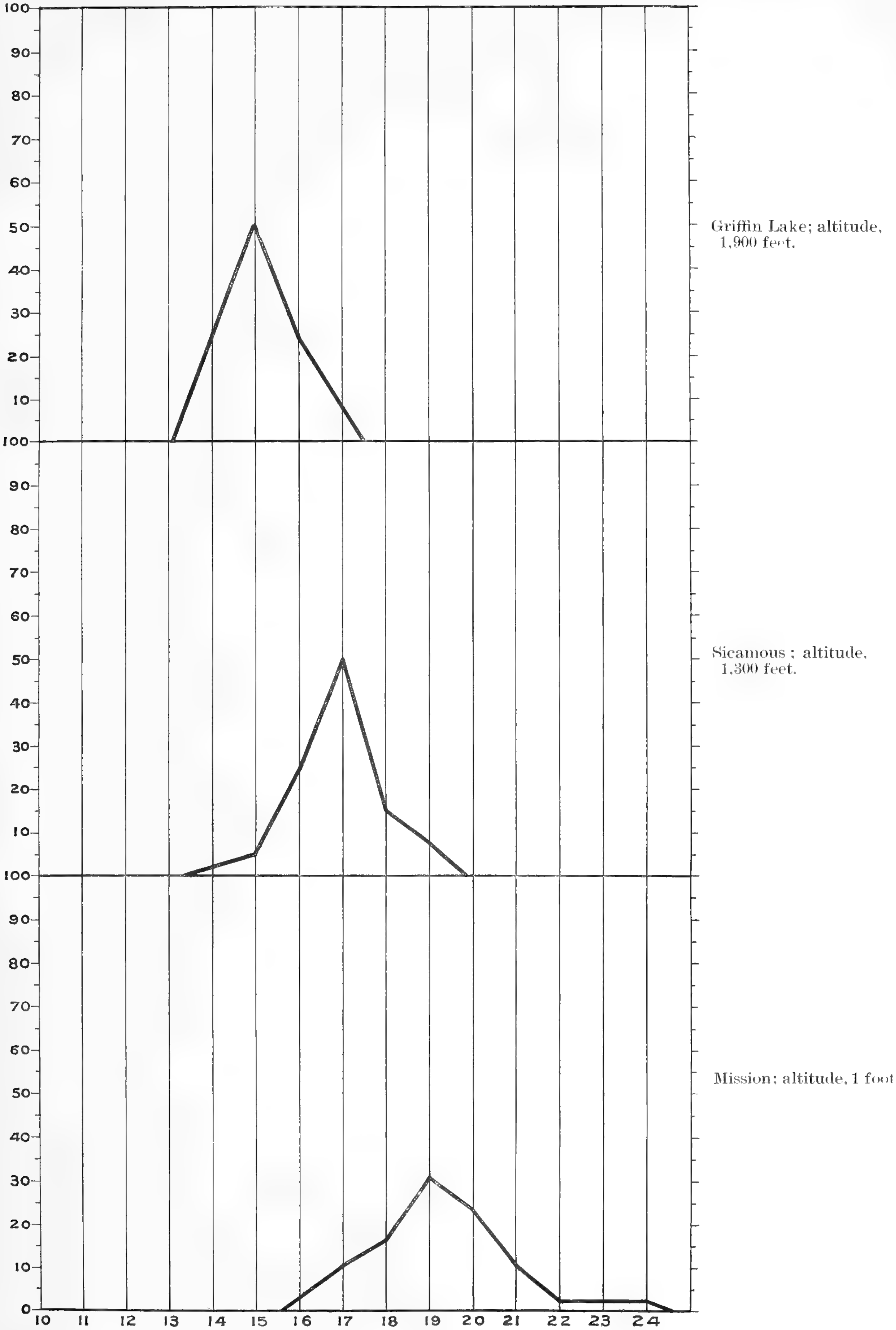
In the table below the numbers in the headings represent the numbers of anal rays found in specimens of *Richardsonius*, and opposite each locality is given the number of specimens from that locality possessing the given number of rays. Thus from Idaho Falls, 2 specimens had 12½ rays in the anal, 14 specimens had 13½ rays, and 4 specimens had 14½ rays. At the bottom is given the nearest per cent that the sum of any given column bears to all the (300) specimens examined.

Locality.	Elevation.	Number of rays in the anal.													
		11½.	12½.	13½.	14½.	15½.	16½.	17½.	18½.	19½.	20½.	21½.	22½.	23½.	24½.
	Feet.														
Provo River (*montanus*)			26	12											
Columbia Basin.															
Idaho Falls (*hydrophlox*)	4,712		2	14	4										
La Grande	2,786				2	6	11	4							
Golden	2,550				1	7	5	4	1						
Caldwell	2,372				1	2	6	7	8	7	2	1			
Revelstoke	1,475					1									
Umatilla	300							1	5	1	2	1			
Fraser Basin.															
Griffin Lake	1,900			3	3	7	3	1							
Sicamous	1,300				1	3	13	28	8	5					
Kamloops	1,158										1	1			
Mission	1						2	7	13	25	18	8	2	2	2
Per cents			9	9	4	8	13	17	11	12	8	4	1	1	1

Taking all the specimens recorded (300), adding the columns, and representing the variations in the anal rays in a curve,* we find that there is a certain number of shoulders or peaks. Each of these represents a distinct species or variety. The extent of intergradation can be measured by the depth of the valley between any two peaks. In well-separated species the slopes of the two peaks would not meet. Now it will be noticed that the depth of the valley between the two right peaks is quite shallow; and, in fact, I find the variation almost perfect between *L. balteatus* and *lateralis*, the two varieties represented by these two peaks. The valley between the middle one and the two on the left is deep. In other words, *L. lateralis* is well separated in the character under consideration from *L. hydrophlox* and *montanus*, the species represented by the peak to the left. On the other hand, the latter species merge into each other perfectly in the number of rays.

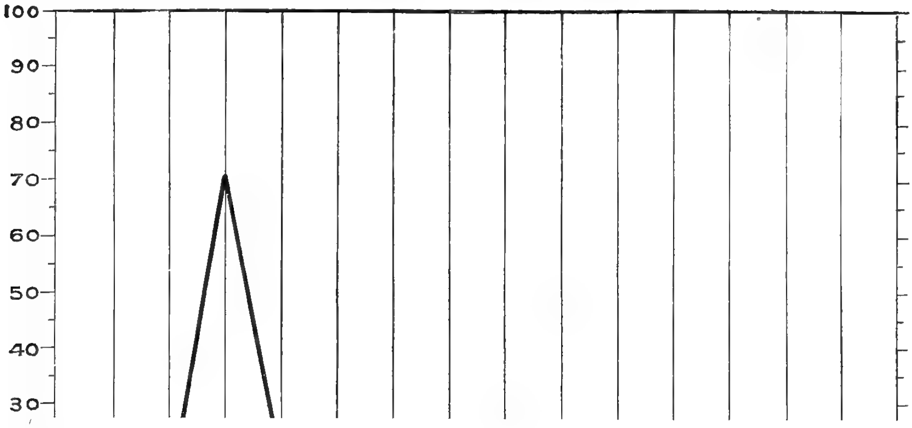
I have represented in a double curve or composite photograph, as it were (plates

* By an oversight this curve has been omitted. The height of the curve in millimeters at various points is indicated by the numbers at the bottom of the table. With these the curve can easily be constructed by using the lines of plate 7 or plate 8.

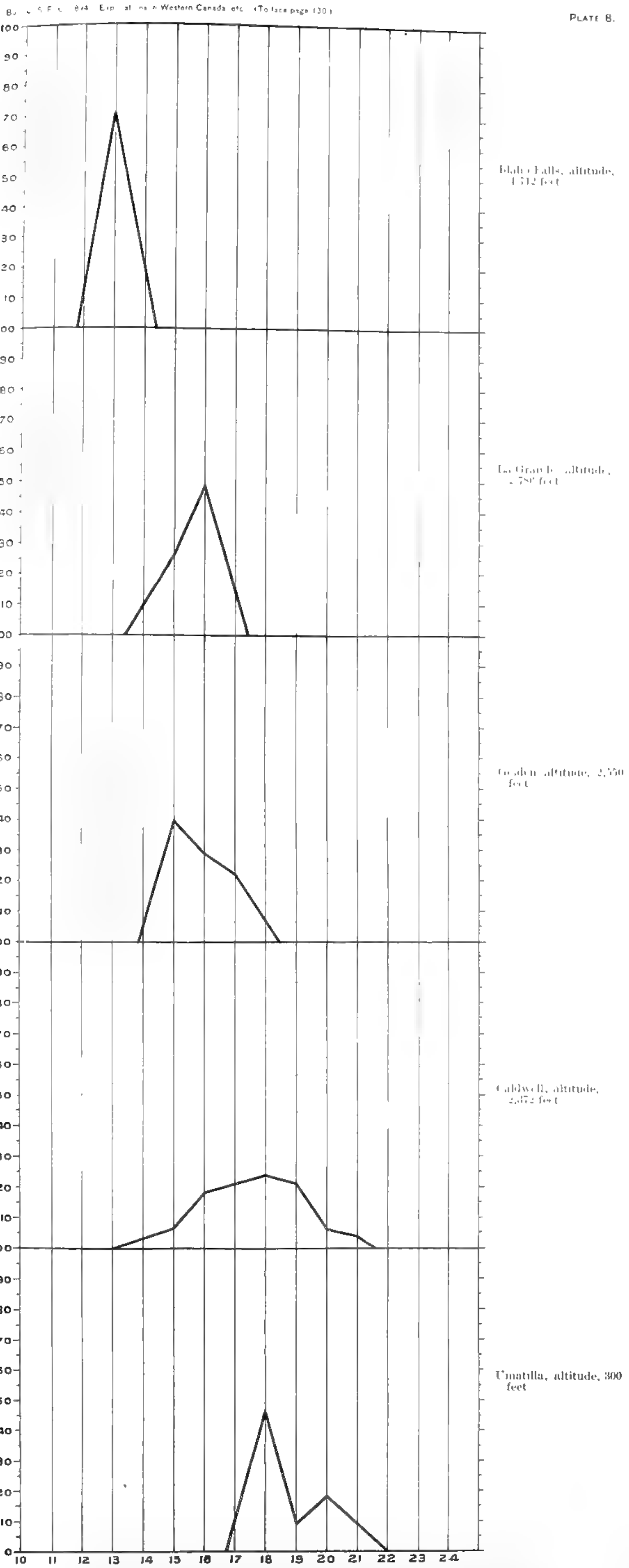


LOCALITY CURVES OF THE ANAL FIN OF LEUCISCUS LATERALIS AND BALTEATUS IN THE FRASER BASIN.

Below are given the anal rays, on the left the percents to 100. The curves represent the percents of specimens having the given number of anal rays. At Mission the greatest percent have 19 anal rays, at Sicamous 17, and at Griffin Lake 15.



Idaho Falls; altitude, 4,712 feet.



LOCALITY CURVES OF THE ANAL FIN OF LEUCISCUS LATERALIS AND HYDROPHLOX IN THE COLUMBIA BASIN

Figures as in plate 7. The uppermost curve represents *Leuciscus hydrophlox*, the others *Leuciscus lateralis*.

7 and 8), the variations in the one point, the number of anal rays for each locality where a sufficient number of specimens were obtained. It will be seen that while the curves for different localities in some cases resemble each other closely, there are no two which are exactly alike. In other words, each locality has its own variety, which in the aggregate is different from the variety in every other locality.

In order to have these curves give exact results an equal number of specimens ought to have been taken from each locality, but this was impossible, and the curves are therefore based on different numbers of specimens. The highest point would probably in no case be moved either to the right or to the left by an examination of a larger number of specimens, but the width of the curve would probably be greater and the height along the different perpendicular lines might be greater or less. In other words, the smaller the number of specimens the higher and narrower will be the curve.

There are presented three curves for three localities with different altitudes on the Fraser system (plate 7). The number of specimens was, respectively, 79, 58, and 14; the elevation 1, 1,300, and 1,900 feet. The variation is seen to be much greater in the lowest locality, a fact which can not be entirely attributed to the greater number of specimens examined, for the variation from the normal, which is 19 rays, to a higher number of rays, is as great as the entire variation for the next locality.

In the second locality a much larger per cent have the normal number of rays, but the normal number has been decreased to 17. The specimens from this locality, with two exceptions, I have identified as *L. lateralis*. Those from the first locality, Mission, represent *L. balteatus*.

The third list is interesting from the fact that the normal number of rays is again moved two rays to the left. In other words, the higher the altitude the fewer the number of rays and the narrower the limits of variation. Moreover, the curves are not symmetrical for any of the three localities, but in the aggregate the more gradual slope is on the side of an increased number of rays, a condition which, considering the general variation of rays on the Pacific Slope, seems to indicate that the number of rays of the species of this genus in the Fraser system is increasing and that the increase is progressing from lower to higher altitudes.

The curves for the Columbia system (plate 8) are not so unanimous in their indications. It will, however, be noticed that, with one exception, they show that the number of rays decreases with the increase of the altitude, the highest point examined, Idaho Falls, having the fewest rays. These specimens represent *L. hydrophlox*, which, with *montanus*, does not descend from the mountains or high plateaus.

The greatest variation in this system was not at the lowest altitude, but at an elevation of 2,372 feet. None of the curves are symmetrical, but the asymmetry is again, as in the Fraser system, greater on the right than on the left. The variation is again greater toward the higher number of rays than toward the lower.

I am not aware that a similar attempt has been made before to represent variations between localities. While the curves here given will no doubt vary slightly with every additional specimen examined, the nature of the curve will probably not be greatly changed. Certainly the important point, that each locality has a variety which in the aggregate is different from the variety of every other locality, can not be gainsaid; nor are additional specimens likely to overthrow the generalization that the number of rays in the species considered decreases with the altitude.

GENERAL SUMMARY OF THE RESULTS.

The fish fauna of the whole region traversed is poor in comparison with that of the streams of the Ohio Valley. I obtained in all but 65 species, about 20 per cent of which were new to science. They belong to 14 families and 37 genera. In the Winnipeg system, *i. e.*, in the whole region drained by the tributaries of Lake Winnipeg, only 3 of the 10 families characterizing the Nearctic region were obtained, and the Pacific Slope contains only two.

The following notable additions to the knowledge of the North American fauna were made by these explorations:

1. A species of *Pantosteus* (*P. columbianus*= *P. jordani* of the Missouri) discovered on the Pacific Slope.
2. *Noturus flavus* found at the base of the Rockies at Craig, Mont.
3. Four new species of *Notropis* added to the east-Canadian fauna.
4. Two new species of *Agosia* added to the Pacific fauna.
5. A new species of whitefish (*Coregonus coulteri*) discovered in the Rocky Mountain streams of a restricted region in British Columbia.
6. The family of *Percopsidæ* found to have a representative on the Pacific Slope in the new genus *Columbia*.
7. Several species of *Etheostoma* found in Canada, among them two new species.
8. One new *Cottus* (*C. onychus*) added to the fauna of the Saskatchewan.
9. A new *Cottus* (*C. philonips*) discovered in the Kicking Horse at Field.
10. A species of *Lota* reported both in the Columbia and the Fraser. A specimen since secured from the Columbia.
11. It was discovered that the fins of the fishes of the Pacific Slope vary from the fins of fishes of the Atlantic Slope in definite directions.
12. The extent of variation between the species of any given family of fishes on the Pacific coast was found to be greater than that between the species of the same family on the Atlantic Slope.
13. *Richardsonius* was proved to be a subgenus of *Leuciscus*. Its species were found to vary directly with the locality. Each locality examined has a variety which in the aggregate differs from the variety of every other locality.

NOTE.—Since this paper has been put in type Drs. Jordan and Evermann have placed the proofs of the Fishes of North America in my hands, and I have adopted all the changes in nomenclature suggested by them up to *Cyprinidæ*. Dr. Jordan has also made many suggestions regarding the chapter on "Structural Peculiarities," etc., p. 122. I have not been able to give these suggestions the attention they merit, but they will receive due consideration in a more detailed study of this subject.

12.—NOTES ON THE FISHES OF WESTERN IOWA AND EASTERN NEBRASKA.

By SETH EUGENE MEEK,

Associate Professor of Biology and Geology, Arkansas Industrial University.

During the years of 1889 and 1890 I made some explorations of the streams of Iowa. The results were published in the Bulletin of the U. S. Fish Commission for 1890, pages 217 to 248. A few collections from western Iowa were not included in the above-named paper. In 1891 Prof. P. B. Burnet, Cotner University, Lincoln, Nebr., and myself collected in a few localities in eastern Nebraska.

In 1892 and again in 1893, while making investigations for the selection of a site for a fish-cultural station in Iowa, Prof. Evermann made some observations upon the fishes at the places visited by him. The present paper is based upon these various small collections, and may be considered as supplementing my "Report upon the Fishes of Iowa," already mentioned.

Collections were made under the direction of the U. S. Commissioner of Fish and Fisheries in 1890 in Little Sioux River and Mill Creek (one of its tributaries), and in Storm Lake, Spirit Lake, and Floyd River; and in 1891 at the following points in eastern Nebraska: Salt Creek near Lincoln, Platte and Elkhorn rivers at Fremont, and Blue River at Crete.

Prof. Evermann's notes are chiefly upon fishes observed by him at Ames, Waterloo, and Spirit Lake.

All the streams in western Iowa are short and of small size. Those north have more or less sandy bottoms, while those in the southwestern part of the State are very muddy. The country is decidedly prairie and more rolling in the northwest.

Spirit Lake.—This lake is in Dickinson County, Iowa, in the northwestern part of the State. The Minnesota State line crosses the extreme northern part of the lake. The greatest length and width are each about 4 miles and the total area 10 to 12 square miles. The southern half is from 1 to 1½ miles wide from east to west. This portion of Iowa is, of course, a glaciated region, and the shores and bottom of Spirit Lake are composed of drift material. The shores are low and gently sloping, as a rule, and are made up of clay, sand, and fine and coarse gravel. No marl was noticed, and but little marshy shore was seen. No trustworthy information as to the depth of this lake could be obtained, but it is probably not greater than 100 feet. The water is clear and cold. There is not a great deal of vegetation in the lake, but patches of *Algæ*, *Myriophyllum*, and *Chara* were seen in places. Several species of *Unionidæ* are found in considerable numbers, and crawfish and frogs are abundant.

Spirit Lake is one of a group of lakes in Dickinson County. At the northwest corner of Spirit Lake, and separated from it by only a few rods, in some cases only a few feet, are Grover, Little Spirit, Hottes, Sunken, and Marble lakes. All of these are small, but of considerable importance as furnishing large quantities of food-fishes.

They do not differ, in general character, from Spirit Lake, except that they are more shallow and have a more abundant vegetation. Little Spirit Lake is particularly well supplied with various species of aquatic plants and also with several species of valuable food-fishes, such as black bass, ring perch, wall-eyed pike, and pickerel.

South of Spirit Lake are East and West Okoboji, two lakes of considerable size and importance. East Okoboji is a long and very narrow lake, the width being about one-half mile and the length not less than 8 miles. This lake is separated from Spirit Lake by a narrow neck of land not over 300 feet wide at the narrowest point. West Okoboji Lake lies west of East Okoboji, with the southern end of which it is connected by a narrow, shallow channel. This lake is the largest and most important of the group.

Among the almost innumerable lake-groups of the northwest there is none possessing a greater interest to the lover of angling than does that which centers about Spirit Lake and the two Okobojies. Both species of black bass, calico bass, ring perch, gray pike, pickerel, and wall-eyed pike abound; and in the pure, clear, and cold waters they have attained a gaminess of disposition, a firmness of flesh, and a delicacy of flavor quite unknown to him who is acquainted only with the less gamy fishes of our warmer rivers and lakes. These lakes are situated in a beautiful country and are easily reached over either of two well-equipped railroads (the Burlington, Cedar Rapids and Northern, and the Chicago, Milwaukee and Saint Paul). Excellent hotel accommodations can be had, and he who goes to Spirit Lake in quest of health and recreation in piscatorial sports will leave with regrets and resolves to return another year.

Little Sioux River is the outlet to Spirit and the Okoboji lakes. It flows through a prairie region, over a sandy or muddy bottom. At Cherokee at the time of our visit it was little more than a creek. *Mill Creek*, one of its small tributaries near Cherokee, is similar to the Little Sioux, only smaller.

Storm Lake is at the head waters of the Raccoon, Boyer, and Little Sioux rivers, its outlet being in the first of these. It is in a prairie region and has a very scanty growth of timber on its shore. The lake is comparatively shallow, not being over 15 or 20 feet in depth, while a large share of it is less than 7 feet in depth.

Mr. Ezra Hurd, of Storm Lake, informs us that black bass are found in the lake, but in small numbers, having been put there about five years ago. He also says that the largest fish in the lake are the buffalo, catfish, eel, perch, redhorse, and what is called the black sucker. From the fact that he says the latter contains but few bones and is the best fish in the lake, we take it to be the Missouri sucker *Cycleptus elongatus*. Aside from this fish, the pickerel (*Lucius lucius*) and the perch (*Perca flavescens*) are the most important, and are found in great abundance. If the wall-eyed pike is found in the lake, it is very scarce. It seems strange that the best food and game fishes (wall-eyed pike and black bass) found in Spirit, Okoboji, and Clear lakes are not found in Storm Lake or, if found at all, are very scarce. It may also be worth while to remark that the minnow *Notropis hudsonius*, which is very abundant in Spirit, Okoboji, and Clear lakes, was not found in Storm Lake.

Floyd River is a rather small stream in northwestern Iowa. It empties into the Missouri River at Sioux City. The Floyd at Lemars is only a small creek. A dam across the stream at this point causes the water to back up and form a few small lakes. The bottom of the stream is sandy and muddy. The heavy rains previous to our visit made it difficult for us to seine above the dam, so most of our collecting was done in the stream just below the dam. At Sioux City the Floyd is some larger and has a

muddy bottom. There is also a dam across the stream at this point. Our collection was made just below it.

Eastern Nebraska is a considerably elevated and rolling prairie, containing very little timber, even along its streams. Its rivers and creeks are typical prairie streams. The running water in them, except in times of drought, is usually turbid, and their currents are swift, much more so than in the streams in Iowa.

Platte River is the largest and most important stream in eastern Nebraska. At Fremont, where visited, it is very wide and shallow, and resembles very much the Missouri River. The Platte is very full of shifting sand bars, and its water has the same milky appearance as that of the Missouri. The fishes taken from the Platte have a very pale, sickly color, which soon changes to a more natural color when the fishes are placed in clear water. Our collections were made from the river and from some bayous near by, which are connected with the river in times of high water.

Elkhorn River is one of the larger streams in eastern Nebraska. It empties into the Platte a few miles below Fremont. It has a sandy and muddy bottom and a very swift current. Our collections were made from the river, from a bayou, and from a small creek between the river and Fremont.

Blue River, near Crete, is somewhat smaller than the Elkhorn, but very similar to it in other respects. Blue River is a tributary of Kansas River. Our collections were made from both branches of the Blue River, a few miles west of Crete.

Salt Creek, near Lincoln, is a small stream with usually a muddy bottom and swift current. Our collections are from the creek and from some large ponds, or lakes, near the creek and connected with it in times of high water.

LIST OF SPECIES OBTAINED.

1. **Lepisosteus osseus** (Linnæus). *Long-nosed Gar.* Common in Spirit Lake.
2. **Noturus gyrinus** (Mitchill). Found in Platte River at Fremont, Floyd River at Lemars and Sioux City, and in Storm Lake. It does not appear to be common at any of these places.
3. **Noturus flavus** Rafinesque. Found by me only in Salt Creek near Lincoln, where but few examples were seen.
4. **Ameiurus melas** (Rafinesque). Platte and Elkhorn rivers at Fremont, Salt Creek at Lincoln, Floyd River at Lemars, and in Storm and Spirit lakes. Apparently not common at any of these places.
5. **Ictalurus punctatus** (Rafinesque). *Channel Cat.* Blue River at Crete, Platte and Elkhorn rivers at Fremont, and Salt Creek at Lincoln. Common.
6. **Ictiobus cyprinella** (Cuvier & Valenciennes). *Buffalo.* One small specimen taken in the Elkhorn at Fremont.
7. **Ictiobus bubalus** (Rafinesque). *Small-mouthed Buffalo.* Abundant in Floyd River below the dam at Sioux City. It is also found in East Okoboji Lake, where 2 or 3 small specimens were obtained. Very large buffalo fish are reported from this lake, which are probably this or the preceding species.
8. **Carpiodes velifer** (Rafinesque). *Quillback.* This small sucker appears to be common in Blue River at Crete, in the Platte and Elkhorn rivers, and in the Floyd River at Sioux City, below the dam. Dorsal rays, 24 to 30; scales in the lateral line, 36 to 41; head, $3\frac{3}{4}$ to 4; depth, $2\frac{1}{3}$ to 3.
9. **Catostomus teres** (Mitchill). *Common Sucker.* Apparently common in Floyd River at Lemars and Sioux City.
10. **Catostomus nigricans** Le Sueur. *Hog Sucker.* At Waterloo, Iowa, July 18, 1893, I examined the contents of the live box of a man who supplies live bait to the enthusiastic local anglers for black bass, pike, and pickerel. The box contained no fewer than 7 species, viz: 2 suckers (the above and *Moxostoma macrolepidotum duquesnei*), 3 minnows (*Campostoma anomalum, Cliola vigilax*, and *Notropis whipplei*), and 2 darters (*Etheostoma caprodes* and *Etheostoma evides*). All these specimens were taken in the Cedar River at Waterloo. (Evermann.)

11. Moxostoma macrolepidotum duquesnei (Le Sueur). *Common White Sucker.* Common in Blue River at Crete, Nebr. A few specimens examined at Lemars, Iowa, from the Floyd River just below the dam. Also seen among "live bait" at Waterloo, Iowa.

12. Placopharynx carinatus Cope. *Big-jawed Sucker.* Very abundant in the Floyd River at Sioux City and Lemars.

13. Campostoma anomalum (Rafinesque). *Stone-roller.* A few were obtained in Floyd River at Sioux City, but it was found in considerable numbers in College Creek at Ames. Also seen among "live bait" at Waterloo, Iowa. (Evermann.)

14. Hybognathus nuchalis Agassiz. Abundant in the Platte River at Fremont, less so in the Elkhorn at Fremont and Salt Creek at Lincoln. It was also found to be a common minnow in the Floyd River at Sioux City and Lemars, and in College Creek at Ames. In individuals $2\frac{7}{10}$ inches long the intestine was 9 inches in total length.

15. Pimephales promelas Rafinesque. Blue River, Crete, Nebr.; Platte River, Fremont, Nebr.; Elkhorn River, Fremont, Nebr.; Salt Creek, Lincoln, Nebr.; Floyd River, Sioux City and Lemars, Iowa; College Creek, Ames, Iowa; and Storm Lake, Iowa. Abundant in all suitable places.

16. Pimephales notatus (Rafinesque). Found at Fremont in the Elkhorn, at Crete in Blue River, at Sioux City and Lemars in the Floyd, and in College Creek at Ames. Common at Ames only.

17. Cliola vigilax Baird & Girard. Seen in "live bait" box at Waterloo, Iowa. (E.)

18. Notropis heterodon (Cope). Found among the weeds near the shore of Storm Lake and in College Creek at Ames. An examination of Prof. Hay's type of *Notropis germanus*, which came from Smoky Hill River at Wallace, Kans., shows that it belongs to this species. The specimen is in very poor condition.

19. Notropis cayuga Meek. This minnow was found in limited numbers in Floyd River at Sioux City and Lemars, in Storm Lake with *N. heterodon*, and in College Creek at Ames. At Ames it is an abundant species.

20. Notropis deliciosus (Girard). Abundant in Platte and Elkhorn rivers at Fremont, Salt Creek at Lincoln, Blue River at Crete, and Floyd River at Sioux City and Lemars. Less common at Crete than elsewhere.

21. Notropis gilberti Jordan & Meek. A few individuals were found in the Floyd River at Sioux City and Lemars

22. Notropis topeka Gilbert. Found in Salt Creek at Lincoln, Blue River at Crete, and Floyd River at Sioux City and Lemars. It was found in greater numbers in Salt Creek than elsewhere.

23. Notropis hudsonius (De Witt Clinton). A few specimens were obtained from the Floyd River at Sioux City, while in Spirit and the two Okoboji lakes it is by far the most abundant minnow. At these lakes it is the principal minnow used by local fisherman as live bait.

24. Notropis lutrensis Baird & Girard. Platte and Elkhorn rivers at Fremont, Salt Creek at Lincoln, Blue River at Crete, and Floyd River at Sioux City and Lemars. The eastern limit of this widely distributed species seems to be in Central Iowa, it having been found by me in the Des Moines River at Des Moines. Ravenna, Nebr., seems to be near the northwest limit of its range, as it was not found in any of the streams in southwestern South Dakota. To the southward it is an abundant fish in all suitable streams, as far at least as the Rio de los Conchos, in Chihuahua, Mexico, where it was obtained by Mr. A. J. Woolman.

25. Notropis whipplei (Girard). A few specimens from Storm Lake. Noticed also in "live bait" box at Waterloo, Iowa. (E.)

26. Notropis megalops Rafinesque. This species is abundant in College Creek, from which the collection contains 12 young specimens. These do not differ from eastern specimens, except that the caudal peduncle is unusually long. This species is not common in Floyd River at Lemars and Sioux City, and is apparently more numerous in the Elkhorn River at Fremont, Nebr. No specimens were taken from other localities.

27. Notropis jejunus Forbes. This species was found in the Platte and Elkhorn rivers near Fremont, where it appears to be rather scarce.

28. Notropis dilectus (Girard). This species is also common in the Elkhorn River at Fremont, Nebr., and less common in Floyd River at Sioux City, Iowa.

29. Phenacobius mirabilis (Girard). From Blue River at Crete; apparently not common.

30. **Hybopsis kentuckiensis** (Rafinesque). *Chub.* A few specimens from the Elkhorn at Fremont.

31. **Hybopsis storerianus** (Kirtland). This species was found to be common in the Elkhorn at Fremont, Nebr., and scarce in Floyd River at Sioux City, Iowa. No specimens were taken from other localities.

32. **Hybopsis hyostomus** Gilbert. Found in Platte and Elkhorn rivers at Fremont, and Blue River at Crete. Apparently scarce in all of these places.

33. **Platygobio gracilis** (Richardson). *Flat-headed Minnow.* A few small specimens were found in Platte River at Fremont.

34. **Semotilus atromaculatus** (Mitchill). *Creek Chub.* Floyd River at Sioux City, scarce; more common in College Creek at Ames.

35. **Notemigonus chrysoleucus** (Mitchill). *Bream.* Platte River near Fremont, Floyd River at Sioux City, College Creek at Ames, and Storm and Spirit lakes, in all of which waters this species is common.

36. **Hiodon alosoides** (Rafinesque). *Moon-eye.* A few taken in Platte River at Fremont and Floyd River at Sioux City.

37. **Dorosoma cepedianum** (Le Sueur). *Hickory Shad.* A common species in the Elkhorn River in suitable places at Fremont, but less so in the Floyd River at Sioux City.

38. **Percopsis guttatus** Agassiz. *Trout Perch.* Found by us only in Floyd River at Lemars and in East Okoboji Lake, from which latter place four specimens were obtained November 2, 1892, from a minnow box at one of the summer hotels. Mr. H. C. Owen, proprietor of the Lake Park House at Spirit Lake, says that this curious fish is abundant in the lakes in that vicinity and that it is used extensively for live bait. Professor Meek, in June, 1890, made special investigation in East Okoboji Lake for this species, but was unable to find it. The specimens obtained by me vary in length from $3\frac{5}{8}$ to 5 inches. In Mill Creek, a small tributary of the Little Sioux River, which is the outlet of the Spirit Lake group, Professor Meek found *Percopsis guttatus* to be the most abundant species. In these specimens the serrations of the preopercle are much more pronounced than in specimens from the Little Miami River, Ohio, with which I have compared them. (Evermann.)

39. **Fundulus zebrinus** Jordan & Gilbert. Common in Storm and East Okoboji lakes. It will doubtless be found to occur in all the lakes of Iowa and southern Minnesota.

40. **Zygonectes sciadicus** (Cope). Specimens were obtained from the Platte and Elkhorn rivers at Fremont, and 2 young individuals from Floyd River at Lemars. It seems to be very scarce at each of these places. This species and *Z. macdonaldi* Meek very closely resemble each other, although the specimens so far collected show constant, but slight differences. In *Z. sciadicus* the teeth in the upper jaw are in a broad band with the outer ones but little enlarged, and their tips but slightly hooked. Dorsal rays, 10; anal, 11. *Z. macdonaldi* has the teeth of the upper jaw in a narrower band with the outer ones considerably enlarged and decidedly hooked. Dorsal rays, 11 or 12; anal, 13.

41. **Lucius lucius** (Linnæus). *Pike; Northern Pickerel.* Found in Floyd River at Lemars and Sioux City, where it was common; in Storm Lake, where it is the most abundant and most important food and game fish; also in East and West Okoboji and Spirit lakes, in each of which it is abundant, being second in importance only to the wall-eyed pike (*Stizostedion vitreum*).

42. **Pomoxis sparoides** (Lacépède). *Calico Bass.* Specimens of the calico bass were identified at East Okoboji Lake, in which it is said to be a common species.

43. **Ambloplites rupestris** (Rafinesque). *Goggle-eye.* A few specimens were obtained at Sioux City in Floyd River.

44. **Lepomis cyanellus** (Rafinesque). *Green Sunfish.* Common in the ponds of the Nebraska State fish-hatchery at South Bend; also in Platte and Elkhorn rivers at Fremont, Floyd River at Lemars, and in Storm Lake.

45. **Lepomis humilis** (Girard). Common at South Bend, Nebr., in the ponds of the State fish-hatchery; also in Platte and Elkhorn rivers at Fremont, Salt Creek near Lincoln, Floyd River at Lemars and Sioux City, Blue River at Crete, and in Storm Lake.

46. **Lepomis pallidus** (Mitchill). *Blue Sunfish.* Found in Spirit Lake, and doubtless occurring in the other lakes of that group.

47. **Lepomis gibbosus** (Linnæus). *Common Sunfish.* Specimens obtained from Spirit Lake, where it does not appear to be at all common.

48. **Micropterus salmoides** (Lacépède). *Large-mouthed Black Bass.* Common in the Platte and Elkhorn rivers at Fremont, less so in Floyd River at Lemars and Sioux City. It is also found in Spirit Lake, where it is probably common.

49. **Micropterus dolomieu** Lacépède. *Small-mouthed Black Bass.* Among the waters covered by this report, the small-mouthed black bass was found only in Spirit Lake.

50. **Etheostoma nigrum** Rafinesque. Elkhorn River at Fremont, scarce; Floyd River at Lemars and Sioux City, common; College Creek at Ames, and Storm, East Okoboji, and Spirit lakes. It seemed most abundant in Storm Lake. A specimen was found in a minnow bucket at Spirit Lake, where it seems to be used as live bait to some extent.

51. **Etheostoma caprodes** (Rafinesque). *Log Perch.* Several specimens seen in a "live bait" box at Waterloo, Iowa, where it was called "stickleback." (E.)

52. **Etheostoma aspro** (Cope & Jordan). *Black-sided Darter.* A few specimens found in Floyd River at Sioux City.

53. **Etheostoma evides** (Jordan & Copeland). A very brilliantly colored male of this beautiful darter was noticed among the minnows in the live box of a fisherman at Waterloo, Iowa, July 18, 1893. The nose, lower jaw, opercles, and cheeks, were of a rich orange in color; rest of head orange but not so rich; eight broad, vertical, greenish bars on side; spinous dorsal plain. Several local fishermen to whom this fish was shown called it a "stickleback," and I learned that this is the name which they apply to all the darters found there. (Evermann.)

54. **Etheostoma cœruleum** Storer. *Rainbow darter.* Found only in Storm Lake, where it is not common.

55. **Etheostoma iowæ** Jordan & Meek. This interesting little darter, originally described from Iowa, was found in limited numbers in the Platte and Elkhorn, near Fremont. In the State fish commission ponds at South Bend, Nebr., it was found to be very abundant, the collection containing 42 small specimens from that place. It was found in Floyd River, both at Lemars and Sioux City, but did not appear to be common. We also found it in College Creek at Ames and in Storm and Spirit lakes, 11 specimens from Ames being in the collection. An examination of specimens from these different localities shows considerable variation in the dorsal-fin formula. In 25 specimens from South Bend the dorsal-fin formula was as follows: IX–10 in 9, X–11 in 5, X–10 in 4, IX–11 in 4, IX–9 in 2, and XI–10 in 1. Two of the specimens from Fremont give X–11, and one each VIII–10, IX–10, and X–10. The one specimen we have from Lemars has the dorsal VIII–10. The four specimens from Storm Lake give VII–10, VIII–9, VIII–11, and IX–10, respectively. Of the 11 specimens from Ames four give IX–11, four IX–10, and one each X–10, X–11, and VII–9. Of these 46 specimens, 15 count IX–10, while the variation in 22 others is from IX or X–10 or 11.

56. **Perca flavescens** (Mitchill). *Ring Perch.* Abundant in Storm, East Okoboji, and Spirit lakes. At the mouth of a small inlet near the northeast corner of Spirit Lake, about the last of June, 1890, young yellow perch were so abundant that they could be scooped up by the handful.

57. **Stizostedion vitreum** (Mitchill). *Wall-eyed Pike.* This is by far the most important and valuable fish of Spirit and West Okoboji lakes, where it is known as "pike."

58. **Stizostedion canadense** (C. H. Smith). *Sand Pike; Gray Pike.* Found in Platte River at Fremont, Floyd at Lemars and Sioux City, and in Spirit Lake.

59. **Roccus chrysops** (Rafinesque). *White Bass.* One specimen from Storm Lake. Local fishermen report that it is taken but rarely.

60. **Aplodinotus grunniens** (Rafinesque). *Freshwater Drum.* Common in the Elkhorn River near Fremont.

13.—LIST OF THE FISHES INHABITING CLEAR LAKE, CALIFORNIA.

By DAVID S. JORDAN AND CHARLES H. GILBERT.

Clear Lake is a depression in volcanic rocks in Lake County, Cal. It is irregular in form, about 30 miles in length by 5 to 10 in breadth, and surrounded by mountains of eruptive rocks belonging to the Coast Range. Its waters are generally very clear, with bottom of volcanic gravel and ash. They are derived from mountain streams and springs. The outlet of the lake, Cache Creek, flows through a wild ravine, Grizzly Canyon, through the mountains to the southeast, into the Sacramento Valley. Here the waters sink or are lost in the tules (*Juncus*), very rarely reaching the Sacramento River, except by underground soakage or through tracts of tules without distinct channels.

In a recent visit to Clear Lake, specimens of various species of fishes were obtained, and additional specimens and information have been derived from Mr. Sanford Parrish, of Lakeport, a gentleman interested in the natural history of the region. The fauna is identical with that of the Sacramento River, except that the salmon of the Sacramento can not enter Cache Creek.

1. **Entosphenus tridentatus** (Gairdner). *Lamprey.* Occasionally taken, according to Mr. Parrish; not seen by us.
2. **Catostomus occidentalis** Ayres. *Sucker.* Common. According to Mr. Parrish, another species of *Catostomus*, known as "mullet," exists in the lake, with larger head and stouter body than the common sucker.
3. **Lavinia exilicauda** Baird & Girard. *Hitch; Chy; Silversides* (young). Very common, reaching a length of 14 inches. Young silvery, with a black caudal spot.
4. **Orthodon microlepidotus** (Ayres). *Blackfish.* The commonest fish in the lake, largely used as food. Coloration very dark. Reaches a length of about 15 inches.
5. **Leuciscus crassicauda** (Baird & Girard). *Chub.* Generally common, according to Mr. Parrish; not seen by us. Takes the hook.
6. **Ptychocheilus oregonensis** (Richardson). *Chappaul* or *Shappaw.* Very common, reaching a weight of 15 to 20 pounds. It runs up the streams in the spring. We saw specimens speared by fishermen in Kelsey Creek. This species takes the hook and is often taken on a trolling spoon. The specimens seen were unusually robust in form. Scales in lateral line, 69 in one specimen, 80 in another.
7. **Ptychocheilus harfordi** Jordan & Gilbert. Not seen by us. Occasionally taken, according to Mr. Parrish. "Much smaller and darker than *P. oregonensis*, with smaller scales and does not take the trolling spoon."
8. **Pogonichthys macrolepidotus** (Ayres). *Splittail; "Fresh-water Smelt."* Common, the young (called *P. argyreiosus* by Baird & Girard) especially abundant.
9. **Salmo mykiss irideus** Ayres. *California Brook Trout.* Common in the lake and in most of its tributaries; the ordinary form of trout characteristic of the Coast Range, varying much in size and color in accordance with the food supply and the character of the water. Specimens weighing 12 pounds have been taken in Clear Lake. Mr. Parrish thinks that the young fry remain two to three years in the streams before going down to the lake. In Kelsey Creek, a tributary flowing in on the west side of the lake, are falls some 20 feet in height. Above these falls no trout were found until after they had been planted there.

10. **Gasterosteus microcephalus** Girard. *Stickleback.* Said to be common; not seen by us.

11. **Archoplites interruptus** (Girard). *Perch.* Formerly very common, but now becoming scarcer as its spawning-grounds are devastated by the carp. An excellent food-fish, vigorous and gamy, reaching a weight of $4\frac{1}{2}$ pounds. The destruction of this valuable fish is one of the most unfortunate results of the ill-advised introduction of the carp into California waters.

12. **Cottus gulosus** (Girard). Occasionally taken; several specimens seen. The form described by Dr. Eigenmann under the name of *Uranidea semiscabra centropleura,* from Allen Springs, a tributary of Cache Creek, is apparently not distinct from *Cottus gulosus.*

13. **Hysterocarpus traski** Gibbons. *Viviparous Perch.* Common, reaching a length of 8 inches. It brings forth its young in May and June. The development of this singular fish could be studied here, and may yield interesting results.

Besides these native fishes, the following have been introduced from the streams of the Eastern States:

14. **Cyprinus carpio** Linnæus. *The Carp.* Everywhere very common, burrowing into the mud among the tules or in shallow waters, thus keeping the shoal waters roily all the time. This species is regarded as worthless as food. It destroys the eggs of the Sacramento perch, and also devours the *Vallisneria,* or water celery, on which the canvasback and other ducks feed. In California this species is a nuisance, without redeeming qualities.

15. **Ameiurus nebulosus** Le Sueur. *The Catfish.* Extremely abundant and destructive to the spawn of other species. It is, however, a fair food-fish and much less objectionable than the carp. It is the best fish in the lake except the Sacramento perch and the trout.

16. **Ameiurus catus** (Linnæus). *The Fork-tailed Catfish.* Occasionally taken with the preceding.

17. **Micropterus dolomieu** Lacépède. *Black Bass.* Introduced lately; a very few specimens taken.

14.—NOTES ON THE FRESH-WATER SPECIES OF SAN LUIS OBISPO COUNTY, CALIFORNIA.

By DAVID STARR JORDAN.

The county of San Luis Obispo lies along the coast of California, midway between Monterey and Santa Barbara. It is composed of two or three isolated valleys opening out to the sea, and surrounded on all sides by high and barren mountains. These mountains have served as a barrier, shutting off all access of fishes to the streams of the region from the larger basins of the north and east. The valleys of San Luis Obispo are traversed by clear, swift, cold streams rising in mountain springs. In these streams very few species of fishes are found, and these few, except in one case (*Agosia nubila*), are species which have come into the fresh waters by way of the sea. None of the characteristic types of the San Joaquin and Sacramento valleys are found in San Luis Obispo County. This is evidently not due to any character of the waters, but simply to the fact that these fishes can not reach San Luis Obispo except by descent to the sea. The extreme paucity of species of fishes becomes a fact of some interest in connection with geographic distribution. In the investigations of these streams I received the efficient assistance of Mr. J. F. West, of Paso Robles.

The streams examined were San Luis Creek, Corral de Piedra Creek, and Arroyo Grande.

San Luis Creek is a clear, cold, swift stream which drains the valley of San Luis Obispo. It was examined near Avila, where it is deep and tortuous, with high banks covered with tangled vegetation. Here the following species were seen:

1. **Agosia nubila** (Girard). In springs among watercresses, rather common. A very widely distributed species, found in all springs of the Coast Range, northward. The California specimens may represent a distinct subspecies, but the characters need further comparison.
2. **Cottus gulosus** (Girard). Abundant and large.
3. **Eucyclogobius newberrii** (Girard). Common in the bottom of the stream, in quiet places.
4. **Gasterosteus microcephalus** Girard. Everywhere common, especially in pools away from the current and among weeds.

Corral de Piedra Creek is a clear, cold brook with muddy bottom, full of chara, watercress, and other plants, and reduced in summer to a succession of pools. It flows into a larger stream, Pismo Creek, which in turn runs into Arroyo Grande near its mouth on Pismo Beach. Here was found but one species, the stickleback, *Gasterosteus microcephalus* Girard, which was very common.

Arroyo Grande is a large stream, clear, cold, and rather shallow. It runs swiftly over a gravelly bottom. About the village of Arroyo Grande no fishes were seen.

Lower down in tributary pools and miry places were sticklebacks in abundance. Near its mouth one sculpin was seen.

In this stream and in the others trout are occasionally taken and sometimes salmon enter them from the sea. Lopez Creek, a mountain tributary of Arroyo Grande, is the best-known trout stream in San Luis Obispo County. It is said by anglers that the brook trout exist in the mountains and the salmon trout come up from the sea and "promiscuously mix with it." This seems another way of saying that the brook trout (*irideus*) and the salmon trout (*gairdneri*) are but forms or states of the same fish. The individuals which run to the sea grow larger and are more silvery in color than those which remain in the brooks.

The following is a list of the fishes of the streams of San Luis Obispo County so far as recorded:

1. **Agosia nubila** (Girard).
2. **Salmo mykiss gairdneri** (Richardson).
3. **Salmo mykiss irideus** (Ayres).
4. **Oncorhynchus tschawytscha** (Walbaum).
5. **Gasterosteus microcephalus** Girard.
6. **Cottus gulosus** (Girard).
7. **Eucyclogobius newberrii** (Girard).

In no other stream of the United States in which an equal amount of water flows has so short a list been recorded.

15.—ON THE APPLIANCES FOR COLLECTING PELAGIC ORGANISMS, WITH SPECIAL REFERENCE TO THOSE EMPLOYED BY THE UNITED STATES FISH COMMISSION.

By COMMANDER Z. L. TANNER, U. S. NAVY.

THE SURFACE TOW NET.

The tow net for collecting minute animal and plant forms from the surface of the sea was among the first devices of the naturalist, and the same apparatus has been used at intermediate depths. The range was formerly confined within narrow limits, generally not exceeding a few fathoms, and even then it was not altogether satisfactory, as specimens would naturally find their way into the net while it was being hauled to the surface, the exact depth of their habitat remaining a mystery.

The rings of surface nets in common use by the Fish Commission are of one-fourth inch brass or iron wire, from 12 to 18 inches in diameter; the nets are generally of silk gauze, although they may be made of cheese cloth or other suitable material. The usual practice is to tow them with a small line either astern or over the side while the vessel moves slowly through the water. Another method has been practiced successfully on board the *Albatross* for ten years, which, in combination with a submarine electric light, has added many new species to our collections.

A ring, slightly heavier than ordinarily used with a surface net, has a shank which is inserted into a staff, usually a bamboo pole of sufficient length. The net is of silk bolting cloth. This device may be used at any time when the vessel is lying without headway, or moving very slowly through the water. Its greatest achievements have been in connection with the electric light. At night, preferably from one to three hours after dark, the vessel lying broadside to the wind and without headway, an ordinary Edison 50-candle incandescent lamp, attached to a properly insulated cable, is lowered from the lee gangway, 6 feet or more from the ship's side, just sufficiently to keep it submerged with the ordinary motions of the vessel. Slow-moving forms which are floating on the surface, collect in large numbers at the water line as the vessel sags slowly to leeward, and more active species gather to feed upon them; as soon as the light is lowered, the latter gather around it, as moths about a candle, sometimes in great swarms, and it is then that the net reaps its richest harvests.

Surface collecting has always been a marked feature in the work of the *Albatross*, and improved methods were sought from the first. The opportunities for this line of investigation, without interfering with other work, were unprecedented, as the net above described could be used whenever the vessel was hove-to for sounding, etc., and the tow net was available from the time the trawl was put over the rail until it was on

board again, from half an hour to six or eight hours later. Observing this, it soon occurred to us that something might be done to develop this field of inquiry, and various devices were tried from time to time with greater or less success until, on the 8th of May 1885, the present form of surface tow net, devised by the writer, was first used and became a part of the regular scientific outfit.

IMPROVED SURFACE TOW NET.

The ring is of ⅝-inch galvanized iron, 4 feet 1½ inches in diameter; the net has a ½-inch mesh, thread 24–6 stow, barked, 10 feet in length, same size throughout, and has a pocket of the same material 5 feet in length, which is formed by turning in a portion of the upper end of the net, thus doubling the material for 5 feet from the ring. A small cord is passed around the net between the parts, and is included in the turns of the lashing which secures the net to the ring. There is a drawstring in the lower end of the pocket.

A mosquito-net lining is secured on the lower inside portion of the net, and hangs a foot below it, in order that it may have sufficient slack to insure the outer net taking the strain of towing. An ordinary surface net with 12-inch hoop and a silk-gauze bag, 20 inches in length, is suspended in the mouth of the larger net by four bridles of small stuff secured to the ring; it is intended to collect minute forms that might pass through the coarser material of the large net. A 2½-inch bridle with four legs is secured at equal distance around the ring, and a 3-inch rope hitched through the bight is used for towing.

To prepare the apparatus for collecting: First, lash the lower end of the lining, place it inside of the net and lash the latter; rig out the swinging-boom, reeve the tow rope through a block near its outer end, and bring the hauling part inboard; hitch one end of a small guy rope to the bridle, making the other end fast to the rail. Man the tow rope, attend the guy, lift the net carefully over the rail, keeping the ring in hand, reduce the speed of the vessel to about 2 knots, lower the net carefully into the water by the guy, and haul in the tow line until the ring floats at the desired depth.

The net is taken in by hauling on the guy and slacking the tow line as the ring leaves the water. It is common practice on board the *Albatross* to use two of these nets at the same time, one at each boom, whenever the vessel is engaged solely in surface collecting.

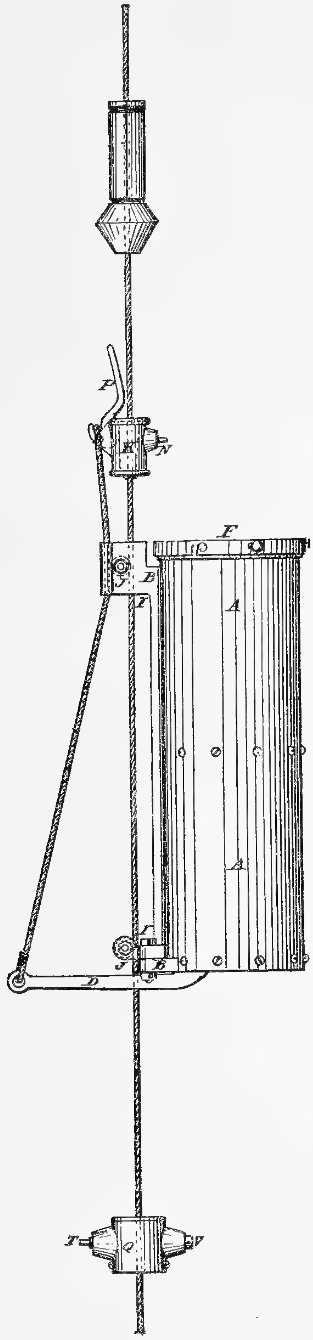
TOW NETS FOR INTERMEDIATE DEPTHS.

The possibilities of a tow net of large size, drawn rapidly through the water for the purpose of taking fish at various depths, were discussed with Prof. Baird in 1882, and, to test the matter, a net was made under the direction of the writer, and used for the first time on May 8, 1883.

The ring was made of 1-inch round iron, and was 10 feet in diameter; the net, 2-inch mesh and 20 feet in length; the bridle had four legs, which were seized at equal distances around the ring, and the steel-wire dredge rope was used as a tow line.

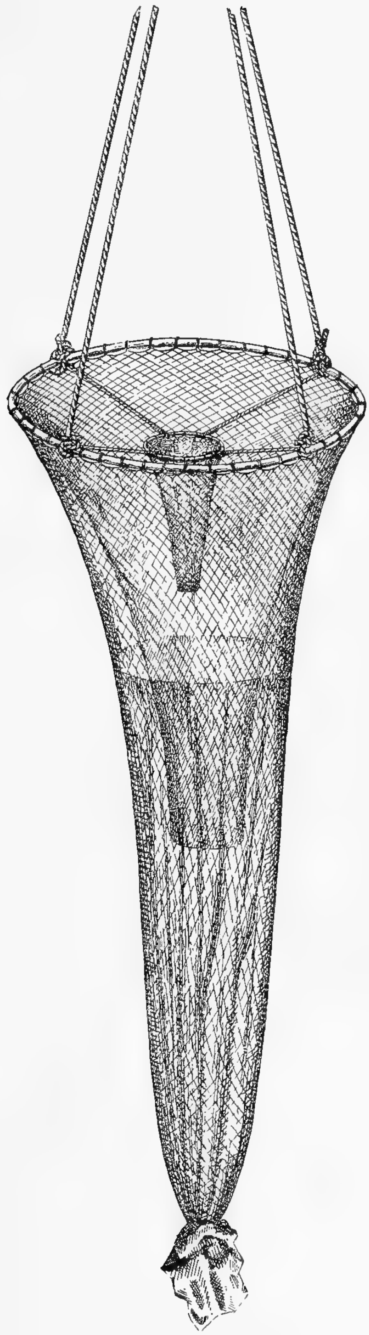
This apparatus was towed at various depths, from surface to bottom, at speeds ranging from 2 to 7 knots per hour, but it failed utterly in so far as the capture of pelagic forms was concerned; any fish which had sufficient celerity of movement to escape a beam trawl would avoid this net. The trouble seemed to arise from its

Fig. 1.



Sigsbee's gravitating trap for obtaining animal forms from intermediate depths.

Fig. 2.



Improved surface tow net.

"firing," for when used at night its track could be distinctly seen several fathoms below the surface. On one occasion, when a school of mackerel was attacked with it on a dark night, we could see the mass separate only a few feet in advance and then promptly close again in its rear, and not one was caught. The school was so dense that it seemed impossible to drag so large a net among them without catching one or two at least; but after an hour or more of towing in every direction at varying speeds from 1 to 8 knots, without the capture of a single specimen, we were impressed with the fact that our latest invention was not a success for mackerel fishing. Slight consolation was afforded us at the reflection that as a crab net it would be immense.

Surface tow nets attached to the dredge rope were used on board the *Challenger* for intermediate collecting, but a knowledge of the depths at which the specimens were secured was still lacking. The same practice was followed on board the *Fish Hawk* until we improved upon it by adopting wing nets, which were attached to each end of the trawl beam, and performed the functions of collectors from surface to bottom, and thence to the surface again. They were like an ordinary tow net with a pocket added. The material was cheese cloth, and being much finer than any portion of the trawl which they accompanied, they usually contained a miscellaneous collection of small forms, many of which would not have been secured by any other method in practice at that time. Of course, we had little knowledge of the depths at which the various forms were secured. Such as were common to both wing net and surface net were, in a general way, assigned to areas within the influence of sunlight, while those found in the wing nets alone were allotted to depths more profound.

SIGSBEE'S GRAVITATING TRAP.

Prof. Alexander Agassiz long felt the need of some reliable method of ascertaining the depth at which specimens were taken, and in 1880 he requested Lieutenant Commander C. D. Sigsbee, U. S. Navy, to coöperate with him in devising the necessary apparatus. Referring to this matter, Sigsbee says (Bulletin of the Museum of Comparative Zoölogy, Cambridge, vol. VI, pp. 155–6):

It occurred to me that by using an apparatus in connection with a line and lead, paid out vertically as in sounding, and by dragging vertically, instead of horizontally, as formerly, there would be as much certainty with regard to depths as in the old method, and that simple mechanical devices could be invented to satisfy the conditions of the work. * * * Our plan is to trap the specimens by giving to a cylinder, covered with gauze at the upper end and having a flat valve at the lower end, a rapid vertical descent between any two depths as may be desired, the valve during such descent to keep open, but to remain closed during the process of lowering and hauling back with the rope. An idea of what it is intended to effect may be stated briefly thus: Specimens are to be obtained between the intermediate depths A and B, the former being the uppermost. With the apparatus in position, there is at A the cylinder suspended from a friction clamp in such a way that the weight of the cylinder and its frame keeps the valve closed; at B, there is a friction buffer.

Everything being ready, a small weight or messenger is sent down, which on striking the clamp disengages the latter and also the cylinder, when messenger, clamp, and cylinder descend by their own weight to B, with the valve open during the passage. When the cylinder frame strikes the buffer at B, the valve is therefore closed, and is kept closed thereafter by the weight of the messenger, clamp, and cylinder. The friction buffer, which is 4 inches long, may be regulated on board to give as many feet of cushioning as desired. * * It is necessary first, to regulate the buffer, to cushion the stoppage of the falling weights, which are, cylinder and frame, 38 pounds; clamp, 4 pounds; messenger, 8 pounds; total, 50 pounds. The *Blake* adopted a resistance of about 80 pounds (this resistance being, of course, constant during the whole movement of the buffer), it having been found that a blow of that

force resulted in no injury to the apparatus. On the ascent the buffer must withstand not only the weight of the 50 pounds of metal, but also the resistance which the water offers to the passage through it of the several parts of the apparatus. Moreover, when the cylinder emerges from the water it is full of that liquid, and with this increased weight would overcome the stated resistance of the buffer and force the latter downwards until the lead was reached. To meet these conditions it was not thought advisable to increase the resistance of the buffer, which would involve a heavier blow against the apparatus, but a rope-yarn seizing or stop was placed on the rope about 15 or 20 feet below the buffer, beyond which the latter could not pass.

Having secured the buffer to the rope about 5 or 6 fathoms above the lead (a very heavy lead to keep the rope straight) and paid out the length of rope required to span the stratum to be explored by the cylinder, the clamp and cylinder are attached, the latter being suspended from the former as follows: The rope having been placed between the two sliding chocks of the clamp, the arm of the eccentric tumbler is thrown up, which moves the chock M inwards; then, by means of the adjusting screw, the chock L is pressed against the rope, securing the clamp in position. The cylinder hangs 4 or 5 inches below the clamp, and is supported by a loop of soft wire which rests on the lip of the tumbler; the ends of the wire, being run through holes in the upper part of the frame of the cylinder, are fastened permanently to the outer arms of the lever D, to which the valve is screwed. It is seen that by this method of suspension the weight of the cylinder and its frame is used to keep the valve closed while paying out. The cylinder should be filled with water, poured down through the upper sieve, to maintain the valve on its seat while the cylinder is being immersed. Rope is then paid out slowly until the cylinder is at the desired depth, when the rope is stoppered and the messenger sent down. The messenger strikes the arm of the eccentric tumbler, throwing it down and tripping the cylinder. The tumbler in falling relieves the pressure on the sliding chock M, which is then free to recede from the rope.

Messenger, clamp, and cylinder fall together, the valve being held open by the resistance of the water. A current is established through the cylinder, and specimens which enter are retained by the upper sieve. When the buffer is reached, the valve is closed by the pressure against the outer arms of the lever.

A very slight pressure on the adjusting screw of the clamp, after the chocks are bearing on the rope, is enough to prevent the clamp from slipping, but by an increased pressure on the screw a greater force is required to trip the tumbler, and by this feature the arm of the tumbler is utilized to break the force of the blow which the body of the clamp receives from the falling messenger.

A few rings of sheet lead may be laid on the top of the clamp and buffer, respectively.

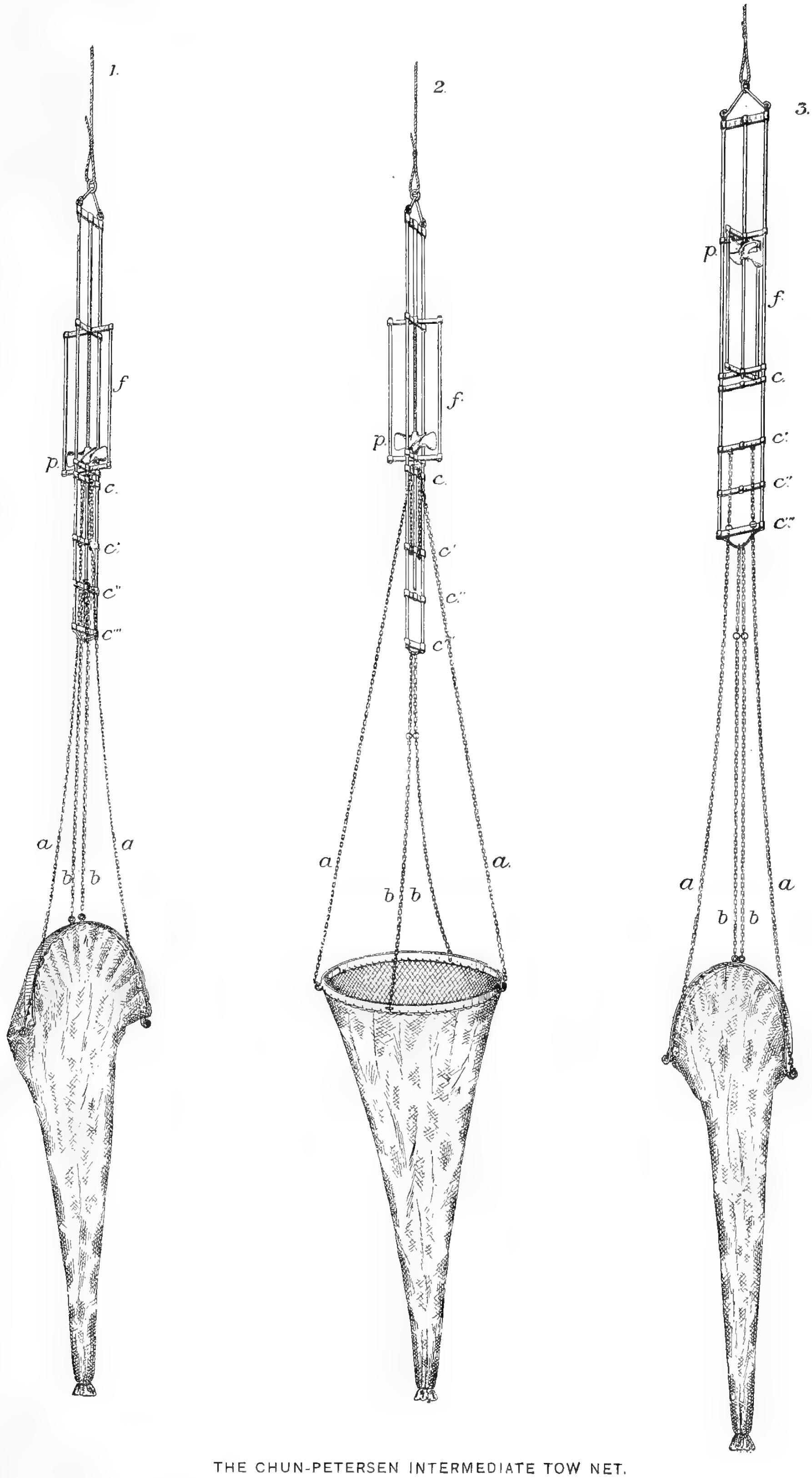
Nomenclature of Sigsbee's Gravitating Trap.

A. Cylinder; copper.	I. I. Loops, or fairleaders.	N. Adjusting screw.
B. Frame; wrought iron.	J. J. Rollers.	P. Eccentric tumbler.
D. Lever.	K. Frame of friction clamp.	X. Messenger.

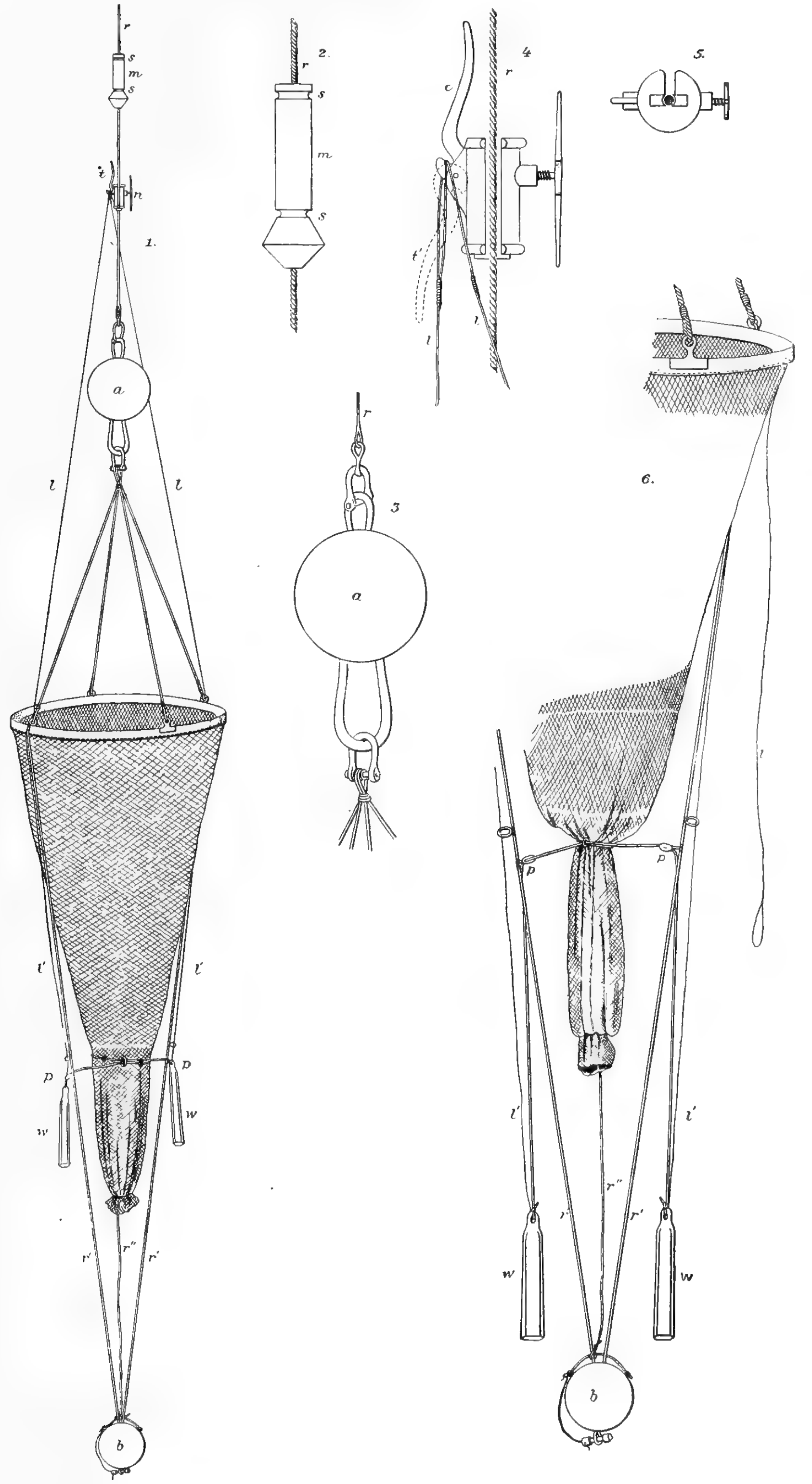
This apparatus was successfully used by Prof. Agassiz on board the *Blake*, but it did not fulfill all the requirements; the strainers were fine-wire sieves, which were somewhat destructive to the more delicate forms, it collected through a vertical area when it was desired to explore horizontally, and its limit of action was strictly confined to the allotted interval on the tow line between the friction-clamp and the buffer. It was the best device of the time, however, and was duly appreciated by Prof. Agassiz.

THE CHUN-PETERSEN INTERMEDIATE TOW NET.

The next apparatus to attract attention was the Chun-Petersen tow net, designed to collect by towing horizontally at known intermediate depths. A slightly modified form of this device was constructed for Prof. Agassiz by D. Ballauf, of Washington, D. C., in 1890, and sent to the *Albatross* early in 1891.



THE CHUN-PETERSEN INTERMEDIATE TOW NET.



THE TANNER INTERMEDIATE TOW NET. FIRST PATTERN.

Describing the apparatus, Agassiz says (Bulletin of the Museum of Comparative Zoölogy, vol. XXIII, No. 1):

Fig. 1 shows the closed net ready to lower; fig. 2, the net opened, ready to tow at the required depth; and fig. 3, the closed net on its way up. *f* is the metal frame protecting the propeller *p*. The propeller shaft extends to the cross bar *c''*, fitting into a socket from which it is relieved after a few turns of the propeller, when the net is first moved horizontally, and liberates the rings of the chain *b* from the bar *c''*, and thus opens the jaws of the net, bringing the strain on the two parts of the chain *a*. As soon as the propeller shaft passes beyond the crossbar *c*, the upper parts of the chain *a* are relieved, and it then becomes the longest, and the strain comes upon the chain *b*, which pulls together and closes the jaws of the net at the termination of the time of towing, and it remains closed until it reaches the surface.

The net was ½-inch mesh, thread 24–6 stow, barked, lined with mosquito-net the entire length, with an inner lining of silk gauze in its lower half.

The apparatus was tested on the 25th of February, 1891, when it was towed near the surface, where every detail of its action could be noted, this precaution having been taken merely as a matter of form, as our confidence in the device was explicit. It was soon apparent, however, that the propeller would not act at all under the low speed required with the fine-mesh net of delicate material needed for our purpose, and, increasing the speed sufficiently to work the propeller properly, the strain on the parts was so great that no dependence could be put upon its uniform action.

THE TANNER INTERMEDIATE TOW NET, FIRST PATTERN.

This element of uncertainty being inherent in the system, we decided to abandon it and seek for some method more direct and positive in its action. I had thought very little of the matter, having perfect faith in the Chun-Petersen device; but, seeing the disappointment of Prof. Agassiz and knowing how important he considered our contemplated exploration of intermedial depths, I set about devising an apparatus for its accomplishment. Taking the ring and net of the Chun-Petersen apparatus, we removed the mosquito-net lining from the upper portion of the latter, and added a bridle having four legs of equal length which were secured around the ring in such a manner that it would remain open at all times.

The steel-wire dredge rope, which served as a tow line, was attached to the bridle by a shackle; the lower bridle has two legs 10 feet in length attached to opposite sides of the ring, and a 60-pound sounding shot is toggled on the bight at the lower extremity to act as a sinker. The lower end of the net being properly secured, the ends of the lashing are carried down to the sinker and made fast, in order to keep the net in place while going down.

Four small brass rings are secured to the bag, at equal distances, a few inches below the upper edge of the silk-gauze lining, and through them is rove a soft white tie line, which makes a complete round turn, the ends being passed through the same ring, then rove through small metal blocks on the lower bridle, and finally secured to leads weighing 14 pounds each. Two tripping-lines with eyes in their upper extremities are hooked over a friction clamp on the tow rope, then rove through small eyes on the rim of the net, and through brass rings on the lower bridle above the metal blocks before mentioned. The ends being hitched to the leads support their weight, allowing the tie or draw string to hang loosely and the net to retain its natural form while sinking and being towed.

To use the apparatus, prepare it as in fig. 1, plate 11, lower it vertically to the proper point, and tow it slowly through the water, veering and heaving in on the tow line in order to maintain the desired depth, which can be determined within a few fathoms by the dredging quadrant, an instrument in constant use on board the *Albatross.*

To recover it, stop and back until the tow rope is vertical, heaving in sufficient line during the operation to keep the net at the proper depth; then send the messenger down to act on the friction clamp, release the tripping lines, and close the lower part of the net as shown in fig. 6.

The net may be run up to the surface at any desired speed, the upper portion taking in anything it encounters en route, while the lower part remains closed against even the most minute forms.

The messenger is in two parts, which, having been placed around the tow rope, are seized together with marline. It sinks at the rate of about 650 feet per minute, and the impact can usually be distinctly felt by taking hold of the tow line.

This apparatus was used successfully to a depth of 1,700 fathoms, yet I looked upon it as a makeshift; the heavy sinker on the lower bridle caused the net to tow at a considerable angle, thus diminishing the useful area of the ring. An improved form of intermediate tow net was subsequently devised by the writer, in which fully three-fourths of the area of the ring does useful work. The apparatus is simplified, and its action more direct and certain.

THE TANNER INTERMEDIATE TOW NET, IMPROVED PATTERN.

This apparatus is composed of a brass frame carrying a net so arranged with drawstring, movable weights, messenger, friction clamp, and tripping lines, that the lower part can be closed at will. Its construction may be readily understood by reference to plate 12 and the following explanations:

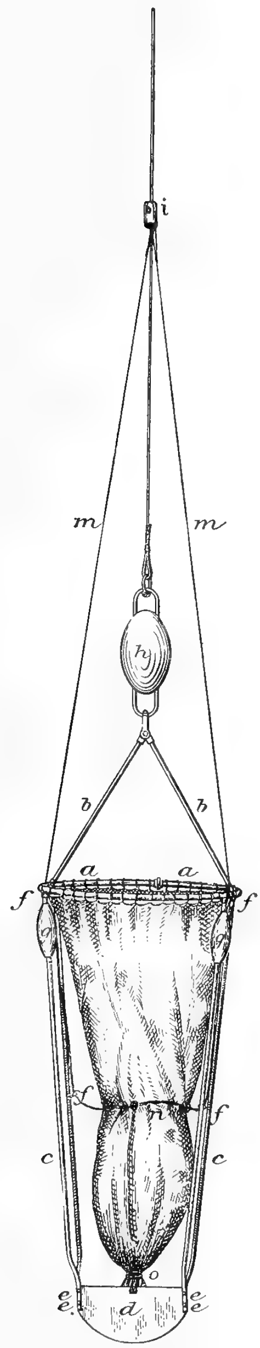
A. A.	Ring: brass pipe.
B. B.	Arms: brass pipe.
C. C. C. C.	Legs: brass pipe.
D.	Apron: sheet brass.
E. E. E. E.	Apron bolts: brass.
	Tees, for arms and legs: brass.
F. F. F. F.	Blocks, for drawstring: brass.
G. G.	Weights for drawstring: lead.
H.	Sinker: cast iron; wrought links.
I.	Friction clamp: frame, brass; tumbler, steel.
K.	Messenger: cast iron.
L.	Wrench: steel.
	Net: $\frac{1}{2}$-inch mesh.
	First lining: mosquito net (for whole net).
	Second lining: silk gauze (for lower half).
	Guide-rings: brass.
N.	Drawstring: braided cord.
O.	Lashing: cod line, cotton.
M.	Tripping-lines: codline, cotton or flax

General description.—The ring is 2 feet 5 inches inside diameter, composed of brass pipe $1\frac{1}{16}$ inch outside diameter, bent in a circular form, the ends joined by a union. On the ring are four tees, two on each side, spaced 6 inches apart, and secured in place. The half of the ring opposite the union is filled with lead, which gives it a preponderance of about 10 pounds.

The arms are of brass pipe of the same diameter as the ring; the lower ends are screwed into tees which move freely on the ring between those above mentioned, the upper ends having a hinge joint held in place by the shackle pin.

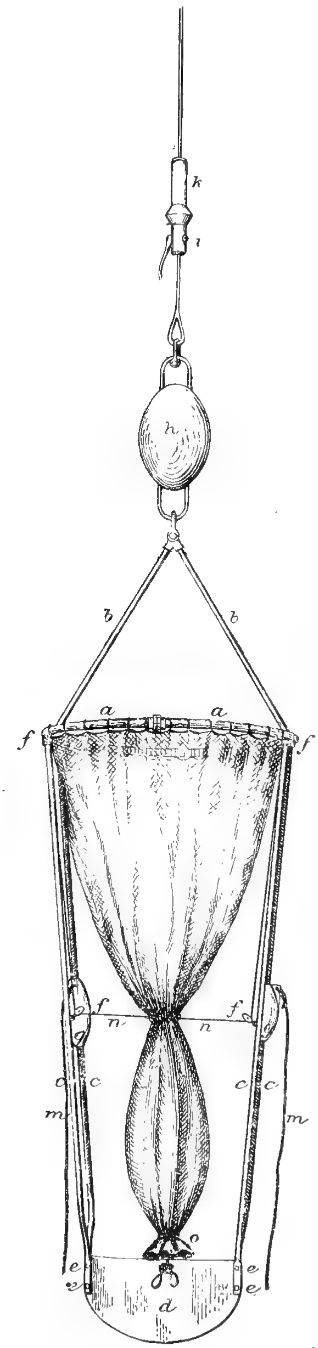
The legs, four in number, are also of brass pipe, $\frac{13}{16}$ of an inch outside diameter and 5 feet $5\frac{1}{2}$ inches total length, with net length (from lower side of ring to apron) 5

Fig. 1.



Tanner intermediate tow net,
ready for lowering.

Fig. 2.



Tanner intermediate tow net,
ready for hoisting.

THE TANNER INTERMEDIATE TOW NET. IMPROVED PATTERN

feet. The lap of legs over the apron is $4\frac{1}{2}$ inches, and the upper ends screw 1 inch into their respective tees.

The apron is of sheet brass $\frac{1}{8}$ inch thick, 18 inches in length; straight on the upper edge, the lower part semicircular with a radius of 10 inches. It is secured to the flattened extremities of the legs by two screw bolts in each end, $\frac{5}{16}$ inch in diameter and $2\frac{1}{4}$ inches in length. An oblong hole in the central upper part of the apron is for the purpose of securing the tail of the net, in order to prevent its floating up or becoming entangled while being lowered.

The functions of the apron are threefold: first, to afford rigid and secure fastenings for the lower ends of the legs; second, by its form to aid in guiding the net down vertically when lowering it to the prescribed depth; and finally, to give the apparatus a tendency to take a horizontal position when towing, thus increasing the area of collecting surface within the ring. The weights are all at or near the ring while the net is being lowered and towed, and there is a preponderance of 40 pounds on one side of it, so placed as to cause the apron to expose its flat surface to the water and greatly increase the tendency of the light rear end to seek the level of the more ponderous weighted ring whenever it is moving forward.

Blocks, four in number, for operating the drawstring, are of brass, $1\frac{1}{4}$ inches in length. Two of them are secured to a pair of legs by through bolts, riveted 2 feet 4 inches above the apron; the others are seized with wire to the tees holding the upper ends of the other pair of legs upon which the movable weights traverse.

The movable weights of lead, two in number and weighing 30 pounds each, are provided to put the required tension on the drawstring when it is desired to close the net. They are egg-shaped, 3 inches in diameter by $7\frac{1}{2}$ inches long, and have an inch hole through the center; $\frac{3}{8}$-inch holes in lugs at their upper extremities furnish a convenient method of attaching the drawstring and tripping lines.

The sinker is of cast iron, 130 pounds weight, oblong in form, with projecting links of wrought iron at each end, through which shackles for attaching tow net and dredge rope pass. The sinker is used to facilitate lowering the net, and to prevent kinking the steel dredge rope or tow line.

The friction clamp is composed of brass and steel, the barrel of the former metal, the eccentric tumbler, sliding chocks, striking face, and adjusting screw of the latter. A small steel wrench is provided to work the adjusting screw.

The messenger is of cast iron, 9 pounds in weight, made in halves, with two scores on the external surface for convenience in passing lashings. To use it, pass the halves over the rope and take a few turns of a lashing. The hole in the messenger is sufficiently large to allow it to pass freely over splices in the dredge rope.

The net is half-inch mesh; thread 24–6 stow, barked; it is seized to the ring with seine twine, and hangs 5 feet 6 inches in length, the same size throughout. It is lined with mosquito netting the whole length, and there is an inner lining of silk gauze extending up 3 feet 6 inches from the lower end. The outer net is intended to take the strain in towing, the linings pressing against it on all sides, and acting simply as collectors. The lower end of the net is closed by a cod-line lashing, which includes the outer net and mosquito-net lining, the silk gauze or inner lining being secured separately and placed inside of the others as an additional protection against wear and tear. After the outer net is securely lashed, the ends of the same lashing are taken through the hole in the apron and knotted, leaving about 6 inches slack to allow for closing the net, shrinkage, etc.

Guide rings for drawstring, six in number, of brass $\frac{3}{16}$-inch wire and 1 inch diameter, are secured to the outer net at equal distances around its surface, 2 inches below the drawstring blocks. They are so placed, in order to give sufficient slack in the upper portion of the net to allow it to close without bringing undue tension on the web.

The drawstring, 13 feet long, is a braided cord $\frac{1}{4}$ inch diameter, used to close the net after towing, and before hoisting it to the surface. Cod line or any other material of the proper size would answer the purpose, but the braided cord was selected as less liable to kink while hanging loosely during the process of lowering and towing; it presents a smooth surface to the net, and reduces to a minimum the wear on the web caused by repeated opening, closing, towing, and hoisting.

Tripping lines, two in number, are of cod line, barked, 9 feet 6 inches long, with a 7-inch loop or eye on the upper end. Any material of proper size may be used.

To assemble the apparatus.—The ring being intact, with the arms lying side by side across it, their lower ends attached to their respective tees, raise the arms and shackle the sinker in place. Shackle the tow line, or dredge rope, to the other end of the sinker, and suspend the ring at a convenient height; screw the legs into their respective sockets, which will be recognized by marks of a center punch, thus— ÷ ÷÷ ÷÷÷ ÷÷÷÷; then place the apron in position and secure it by the screw bolts. The movable weights should not be removed from their legs, ÷ and ÷÷÷÷.

Seize the net to the ring, take one turn of the drawstring around the body of the net through the rings, middle it, and take an overhand knot in it; then pass each end outward through a ring, reeve them through the lower blocks, then through the upper blocks, and hitch to the movable weight through the holes in the lugs provided for the purpose.

Hitch the ends of the tripping lines through the other holes in the lugs, place the friction clamp on the rope, slip the loops over the lip of the tumbler, and slide the clamp up the rope until the weights are suspended about 4 inches below the ring; then with the wrench provided for the purpose, tighten the adjusting screw, keeping the tumbler elevated and pressed against the rope until the clamp grips it with sufficient force to hold it in place. Having once ascertained the proper place for the clamp by measurement it can thereafter be secured at the same joint without further attention to the tripping lines, which may be hooked in place and the weights suspended as desired by simply taking in a trifle more or less at the hitch.

The length of tripping lines, 9 feet 6 inches, was intended to give sufficient drift for the weights to close the net even if the tumbler failed to capsize or the loops to unhook from it. A single weight will securely close the net if from any cause the other fails to act.

To use the net.—Having assembled the parts as directed, and attached the tow line, overhaul the drawstring until the net hangs entirely free from stricture; then swing the apparatus out, taking care that it does not come in contact with the ship's side. Bring the vessel to a dead stop, and lower away about 25 fathoms a minute, until the required depth is reached; then move slowly ahead, veering gently on the tow rope until enough has been paid out to maintain the net at the proper depth. This can be done with sufficient accuracy by observing the angle of the tow line from the vertical, and, after making allowance for the catenary, using the angle and length of rope out as the hypothenuse of a right-angle triangle, the depth represent-

ing the perpendicular. If the triangle is complete and the net towing from 1 to $1\frac{1}{2}$ knots an hour, nothing more is required, but, should it be towing too high, more rope or less speed will be requisite; if below the depth, less tow line or an increase of speed will soon bring it up.

The practice on board the *Albatross* is to observe the angle of rope constantly, using a dredging quadrant designed for that purpose, thus regulating the speed and resultant angle, the data for the construction of the triangle being obtained from the traverse tables in Bowditch's Navigation.

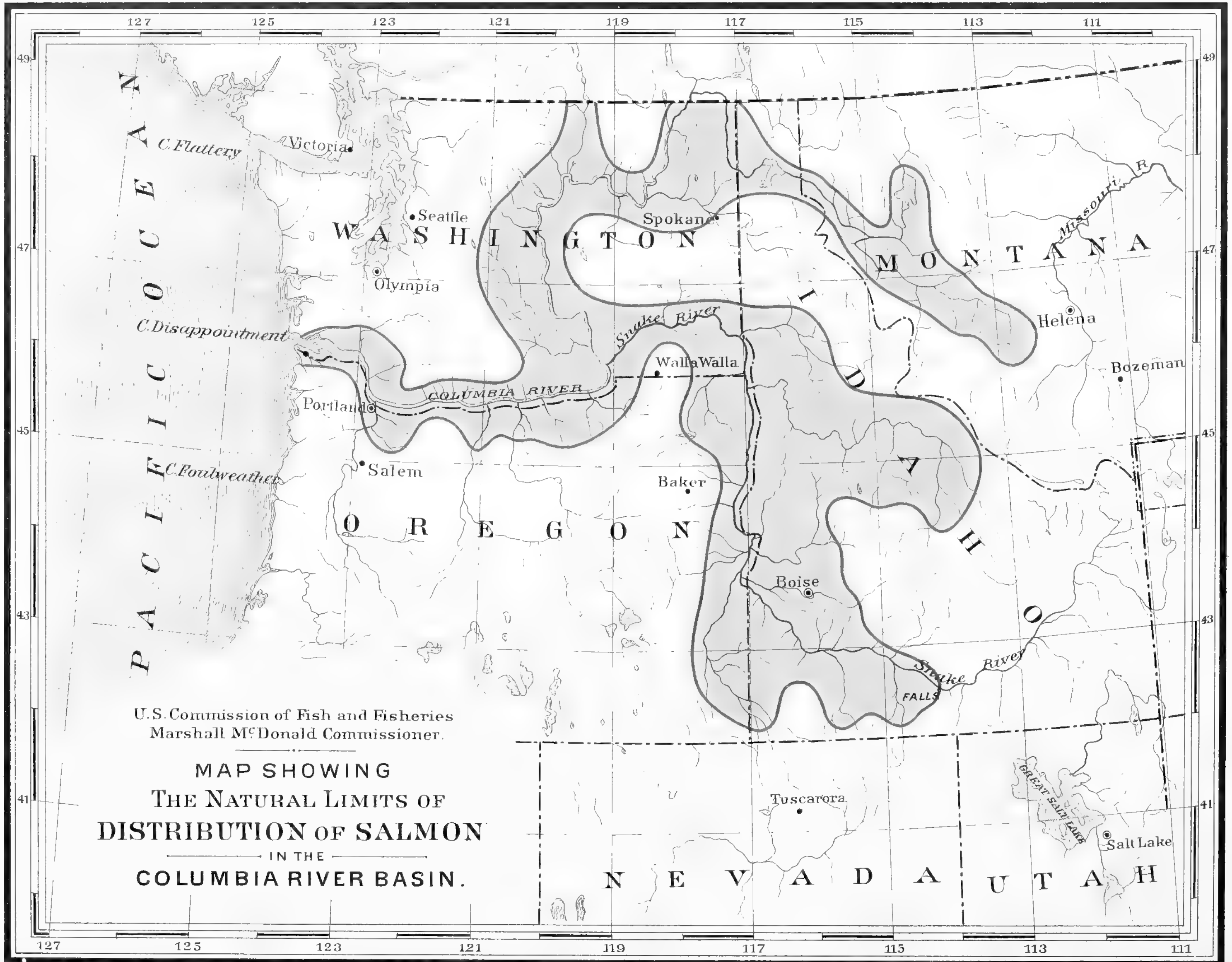
Having towed the net a sufficient length of time, the engines are stopped and the rope reeled in, backing slowly, if desired, to keep the net at its proper depth. When the line is vertical and the vessel at a standstill, send the messenger down to reverse the eccentric tumbler, release the movable weights and close the lower half of the net. The impact of the messenger on the friction clamp can be felt by grasping the tow rope, but this method is not always reliable below 300 fathoms; a safe practice is to time the descent of the messenger for greater depths, allowing about 50 seconds for each 100 fathoms.

Having closed the lower bag, steam slowly ahead and reel in at the rate of 25 fathoms a minute until the net is on board. The upper portion from the mouth to the drawstring remaining open, will usually be found to contain an assortment of specimens collected on the way up.

A few turns of a lashing should be taken around the net immediately below the drawstring, as soon as possible after the apparatus reaches the deck and while it is hanging vertically by the tow rope, to avoid the possibility of opening communication with upper and lower compartments by the accidental slackening of the drawstring. This done, the frame should be lowered gently on deck, the lashing removed from the tail of the net and the parts turned back, leaving the inner or silk gauze lining exposed; remove its lashing, carefully open the bag over a pan of prepared sea water which has been carefully strained to remove any surface forms it might have contained, and finally rinse the net in it to remove minute specimens adhering to its sides or lodged in the numerous folds.

The contents of the lower bag secured, the drawstring is removed, the upper bag turned inside out into a tub of water, and the specimens secured by thorough rinsing, after which the lashing is taken off and the net carefully washed, usually by towing a few minutes if the vessel should be moving slowly through the water; otherwise by washing and repeated rinsings until all trace of life is destroyed. The last rinsing should be in fresh water, and the frame should be wiped off to prevent oxidation.

If the apparatus is to be stowed away, remove the apron, unscrew the legs, hang the ring with net attached in a convenient place to dry. The tripping lines and the drawstring should be hitched to arms or ring and dried. When ready to store, reeve the drawstring in place, roll the net up snugly, and stop it with the ends of the drawstring; remove the shackle pin and fold the arms across the ring, using the tripping lines to hold them in place and to confine the net as far as possible within the ring, thus making a snug and convenient package to handle or store.



U.S. Commission of Fish and Fisheries
Marshall McDonald Commissioner.

MAP SHOWING
THE NATURAL LIMITS OF
DISTRIBUTION OF SALMON
IN THE
COLUMBIA RIVER BASIN.

M. A. C.

LITH A. HOEN & CO. BALTIMORE.

16.—THE SALMON FISHERIES OF THE COLUMBIA RIVER BASIN.

By MARSHALL McDONALD,
United States Commissioner of Fish and Fisheries.

U. S. COMMISSION OF FISH AND FISHERIES,
Washington, D. C., May 31, 1894.

Hon. ADLAI E. STEVENSON,
President of the Senate:

SIR: In compliance with instructions conveyed in the provisions of the Sundry Civil Bill, which became a law August 5, 1892, I have the honor to submit a report of investigations in the Columbia River Basin.

The first of the provisions above referred to authorized the expenditure from the appropriation for inquiry respecting food-fishes of $2,000, or so much thereof as may be necessary, "In examining the Clarke's Fork of the Columbia River, with the view to ascertain the obstructions which prevent the ascent of salmon up said river to the Flathead Lake and adjacent waters."

The second provision directed an investigation and report respecting the advisability of establishing a fish-hatching station at some suitable point in the State of Washington, and appropriated for the same "$1,000, or as much thereof as may be necessary."

It was not known whether the failure of the salmon to enter the Clarke Fork of the Columbia was due to natural obstructions preventing their ascent, or was to be attributed to the extensive fishing operations prosecuted in the Lower Columbia, or possibly to other causes to be disclosed by the proposed investigation. Again, the location of the hatchery proposed for the State of Washington would be necessarily determined by our ability to secure an adequate supply of spawning salmon within convenient distance of the hatchery.

It appearing probable that the methods of the large fisheries pursued in the Lower Columbia, if permitted to continue, would effectually intercept the run of salmon to the headwaters, and thus defeat the object for which the hatchery is proposed, it was thought proper and expedient to institute a general investigation covering the entire Columbia River Basin, and if conditions were disclosed threatening disaster to these valuable and productive fisheries, to bring the matter to the attention of Congress and the States interested in their prosperity.

The direction of the field investigation was intrusted to Prof. B. W. Evermann, assistant in the Division of Inquiry Respecting Food-Fishes, whose report is appended to and constitutes an integral part of the report of the Commissioner of Fisheries.

NOTE.—This paper was first issued August 27, 1894, as Senate Miscellaneous Document No. 200, Fifty-third Congress, second session.

A very complete statistical investigation into the history, methods, apparatus, present conditions, product, and annual value of the salmon fisheries of the Columbia has also been made by Mr. W. A. Wilcox, under the direction of Dr. H. M. Smith, assistant in charge of the Division of Statistics and Methods of the Fisheries, the results of which are embodied and discussed in the report which is herewith respectfully submitted.

CONDITIONS DETERMINING THE SALMON PRODUCTION OF A RIVER BASIN.

There are fundamental conditions determining the salmon production of a river basin and the nature and extent of the fisheries which may be maintained without overtaxing the productive capacity of the river. All the species of salmon which are the object of the fisheries are alike under the constraint of a natural law, which compels them to enter the fresh waters for the purpose of spawning. Some species ascend to a relatively short distance above tide water. Others, like the chinook, push their migrations to the remotest sources of the rivers and tributary streams, when not prevented by natural or artificial obstructions. Where the area of distribution is contracted by the erection of barriers, dams, or other obstructions which the salmon can not surmount, the production of the river is diminished *pro tanto*, for the reason that the young salmon remain for some months in the waters in which they are hatched—they must here find their food—and consequently the extent of the feeding-grounds open to them will be the measure of nature's ability to repair the waste occasioned by natural casualties and the fishing operations. If there be no contraction of the breeding area by artificial obstructions, but, on the other hand, the times, methods, and apparatus of the fisheries are such as to intercept or in a large measure prevent the run of salmon into and up the rivers, then a serious decline in the fisheries is inevitable.

It is possible by fish-cultural operations pursued on an adequate scale, by hatching and planting the fry in the head waters of the Columbia and its tributary streams, to realize the full productive capacity of the river, so long as eggs can be obtained in sufficient numbers to furnish a basis for the extensive operations required. This would not be possible, however, if the fishing operations in the lower river practically excluded the salmon from the streams to which it would be necessary to have recourse to obtain a supply of eggs. It is evident, therefore, that fish-cultural operations can not be relied upon exclusively or chiefly to maintain the salmon supply in the Columbia. The regulation of the times, methods, and apparatus of the fisheries should be such as to assure the largest opportunity practicable for reproduction under natural conditions. Artificial propagation should be invoked as an aid and not as a substitute for reproduction under natural conditions.

THE LIMITS OF MIGRATION OF SALMON.

The limits of migration of salmon in the Columbia River basin, as determined by impassable falls in the larger tributaries of the Columbia and their affluents, is shown in the accompanying chart, there being no serious obstructions existing in the main river within the limits of the United States.

The area of distribution is approximately 90,000 square miles. This immense tract is drained by innumerable streams of clear cold water, into which the salmon enter for the purpose of spawning and up which they ascend till their progress is stopped

by falls or other obstructions which they cannot surmount. These waters furnish the feeding-grounds of the young salmon during their early life, which is spent in the fresh waters. Their migration seaward does not begin until they are at least a year old and have attained a length of from 8 to 10 inches. These streams are the nurseries of the great salmon fisheries of the lower Columbia. From each goes out every year a colony, more or less numerous, to swell the aggregate of young salmon necessary to repair the waste by natural casualty and by capture.

The area of natural distribution has not as yet been very materially abridged. Certain streams, such as the Bruneau and the Boise, have been obstructed by dams near their mouths, but the vast extent of waters still accessible to salmon and affording suitable breeding and feeding grounds, indicates that we must look to other causes to explain any ascertained deterioration in the salmon fisheries of the Columbia.

DECREASE OF SALMON IN THE HEAD WATERS OF THE COLUMBIA RIVER.

The investigations made by Prof. Evermann and the parties under his direction establish conclusively the fact that there has been a very great reduction in the number of salmon frequenting the head waters of the Columbia River and its tributaries. This decrease is more notable in the main river. In the early history of the fishery salmon were found in the head waters in marvelous abundance. According to the information obtained by Prof. Evermann:

> They were abundant in the Columbia River at Kettle Falls as late as 1878. Since then there has been a great decrease. They have been scarce since 1882. Since 1890 there have been scarcely any at Kettle Falls. The Meyers Brothers say that they have been almost unable to buy any salmon for their own table from the Indians for three years. Certain Indians with whom we talked at Kettle Falls said salmon were once very abundant there, but that very few are seen now. Other persons testified to the same effect. Essentially the same information was obtained regarding the decrease of salmon in other parts of the upper tributaries of the Columbia, viz: at Spokane, in both the Big and Little Spokane rivers, and in the Snake River and its various tributaries.

Dr. O. P. Jenkins, an assistant of Prof. Evermann, makes the following report in reference to the Yakima River, Washington:

> The Yakima is the main stream of the valley. It receives many tributaries, the main ones being Manistash and Wilson creeks. The river near the city (Ellensburg) is 160 feet wide, by an average of 10 feet deep, and flows with a velocity of 1 foot per second. Temperature at 9:15 a. m., August 24, 1893, 60° F.; water clear. Those acquainted with the facts state that formerly, up to about 1885, salmon of three or four kinds, including the quinnat, ran up the stream to this valley and spawned in the river in great numbers; at present very few make their appearance.

There is no reason to doubt—indeed, the fact is beyond question—that the number of salmon now reaching the head waters of streams in the Columbia River basin is insignificant in comparison with the number which some years ago annually visited and spawned in these waters. It is further apparent that this decrease is not to be attributed either to the contraction of the area accessible to them or to changed conditions in the waters which would deter the salmon from entering them. We must look to the great commercial fisheries prosecuted in the lower river for an explanation of this decrease, which portends inevitable disaster to these fisheries if the conditions which have brought it about are permitted to continue.

The relations of the decreased number of salmon in the head waters to the development of the commercial fisheries is brought out in a very instructive way by an analysis of the following table:

Summary of the salmon-canning industry of the Columbia River from its origin to the present time.

Year.	Gross weight of salmon utilized.	Number of cases packed.	Value.	Average value per case.	Year.	Gross weight of salmon utilized.	Number of cases packed.	Value.	Average value per case.
	Pounds.					*Pounds.*			
1866	260,000	4,000	$64,000	$16.00	1881	35,750,000	550,000	$2,475,000	$4.50
1867	1,170,000	18,000	288,000	16.00	1882	35,184,500	541,300	2,600,000	4.80
1868	1,820,000	28,000	392,000	14.00	1883	40,911,000	629,400	3,147,000	5.00
1869	6,500,000	100,000	1,350,000	13.50	1884	40,300,000	629,400	2,915,000	4.70
1870	9,750,000	150,000	1,800,000	12.00	1885	35,997,000	553,800	2,500,000	4.51
1871	13,000,000	200,000	2,100,000	10.50	1886	29,152,000	448,500	2,135,000	4.76
1872	16,250,000	250,000	2,325,000	9.30	1887	23,140,000	356,000	2,124,000	5.97
1873	16,250,000	250,000	2,250,000	9.00	1888	24,211,005	372,477	2,327,981	6.25
1874	22,750,000	350,000	2,625,000	7.50	1889	20,685,495	309,885	1,809,820	5.84
1875	24,375,000	375,000	2,250,000	6.00	1890	28,781,385	435,774	2,407,456	5.52
1876	29,250,000	450,000	2,475,000	5.50	1891	26,450,635	398,953	2,240,964	5.62
1877	24,700,000	380,000	2,052,000	5.40	1892	32,185,995	487,338	2,679,069	5.50
1878	29,900,000	460,000	2,300,000	5.00	1893	24,050,000	370,000	2,107,500	5.70
1879	31,200,000	480,000	2,640,000	5.50					
1880	34,450,000	530,000	2,650,000	5.00	Total	658,424,515	10,098,427	59,029,790	5.85

Canning operations on the Columbia River began in 1866, when 4,000 cases were packed and sold at an average of $16 per case. As early as 1872 the total pack reached 250,000 cases, the price per case having declined to $9. Each succeeding year operations were extended and reached their culmination in 1883 and 1884, when upwards of 600,000 cases were packed each season. From this time on the catch declined, having reached its lowest point in 1889, the number of cases packed that season being 309,885, or less than half the number of cases packed in 1883 and 1884.

Up to 1888, practically the entire pack consisted of the king or chinook salmon, and the fishing season did not extend beyond the first of August. In 1889 the packers began canning bluebacks and steelheads to make up the deficiency in the supply, and extended their operations to the first of September.

DETAILED STATISTICS OF THE SALMON INDUSTRY OF THE COLUMBIA RIVER, 1889-92.

The following series of tables shows, in some detail, the extent of the salmon fishery and canning industry of the Columbia River during the years 1889 to 1892, inclusive, as determined by the inquiries conducted by this Commission.

The number of fishermen and shore employés connected with the salmon industry in each of the years named is indicated in Table A:

A.—*Table showing the number of persons employed in the salmon industry of the Columbia River from 1889 to 1892.*

How engaged	1889.	1890.	1891.	1892.
Oregon:				
Fishermen	1,606	1,648	1,929	2,064
Shoresmen and cannery employes	870	1,028	1,057	1,100
Total	2,476	2,712	2,986	3,164
Washington:				
Fishermen	1,535	1,510	1,575	1,677
Shoresmen and cannery employes	594	602	654	704
Total	2,129	2,112	2,229	2,381
Total for river:				
Fishermen	3,141	3,194	3,504	3,741
Shoresmen and cannery employes	1,464	1,630	1,711	1,804
Total	4,605	4,824	5,215	5,545

The number and value of boats and apparatus and the value of shore property and capital employed in the salmon fisheries of the Columbia River in 1889, 1890, 1891 and 1892 is given in Table B.

B.—*Number and value of boats and apparatus, and the value of shore property, and cash capital employed in the salmon industry of the Columbia River in 1889, 1890, 1891, and 1892.*

Apparatus and capital.	1889.		1890.		1891.		1892.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Oregon:								
Boats	751	$99,850	776	$104,400	876	$120,815	998	$131,550
Pile-drivers and scows	21	5,900	23	6,300	30	8,300	29	7,400
Pound nets	102	72,300	98	76,500	140	98,900	247	173,400
Trap nets	2	1,600	....	....	2	1,600	2	1,600
Seines	7	4,800	6	2,700	19	11,150	12	5,650
Gill nets	757	152,000	760	159,450	790	181,265	861	190,100
Wheels	31	120,052	29	107,552	30	108,152	40	132,852
Dip nets and squaw nets	95	475	85	425	60	300	50	250
Shore property	....	502,955	....	486,355	....	455,205	....	507,805
Cash capital	....	395,000	....	581,000	....	520,000	....	614,000
Total	....	1,354,932	....	1,524,682	....	1,505,687	....	1,764,607
Washington:								
Boats	475	60,340	468	59,780	534	67,280	538	64,895
Pile-drivers and scows	39	9,050	37	9,950	42	10,750	45	13,550
Pound nets	62	48,200	70	55,200	98	77,000	131	103,400
Trap nets	2	1,400	2	1,400	2	1,400	1	700
Seines	33	18,700	29	16,400	30	16,900	26	10,000
Gill nets	436	88,775	432	89,480	472	101,780	453	98,130
Wheels	9	25,000	12	48,500	14	45,000	17	49,100
Dip nets and squaw nets	15	75	18	90	23	115	25	125
Shore property	....	245,950	....	247,280	....	321,050	....	282,800
Cash capital	....	304,000	....	331,000	....	332,000	....	330,000
Total	....	801,490	....	859,080	....	973,275	....	952,700
Total for river:								
Boats	1,226	160,190	1,244	164,180	1,410	188,095	1,536	196,445
Pile-drivers and scows	60	14,950	60	16,250	72	19,050	74	20,950
Pound nets	164	120,500	168	131,700	238	175,900	378	276,800
Trap nets	4	3,000	2	1,400	4	3,000	3	2,300
Seines	40	23,500	35	19,100	49	28,050	38	15,650
Gill nets	1,193	240,775	1,192	248,930	1,262	283,045	1,314	288,230
Wheels	40	145,052	41	156,052	44	153,152	57	181,952
Dip nets and squaw nets	110	550	103	515	83	415	75	375
Shore property	....	748,905	....	733,635	....	776,255	....	790,605
Cash capital	....	699,000	....	912,000	....	852,000	....	944,000
Total	....	2,156,422	....	2,383,762	....	2,478,962	....	2,717,307

Comparing 1892 with 1889, we find increases or decreases in the number of the different sorts of apparatus as follows:

Apparatus.	1889.	1892.	Increase.	Decrease.
Pound nets	164	378	214	....
Seines	40	38	....	2
Gill nets	1,193	1,314	121	....
Wheels	40	57	17	....
Dip nets and squaw nets	110	75	....	35

The following tables, C, D, E, and F, show by apparatus the number, weight, and value of each species of salmon taken in the Columbia River in 1889, 1890, 1891, and 1892:

C.—*Table showing by apparatus the number, weight, and value of each species of salmon taken in the Columbia River in 1889.*

Apparatus and species.	Oregon.			Washington.			Total.		
	No.	Pounds.	Value.	No.	Pounds.	Value.	No.	Pounds.	Value.
Pound nets:									
Chinook	86,777	2,169,425	$108,469	40,323	1,008,075	$50,353	127,100	3,177,500	$158,822
Blueback	33,372	166,860	8,342	24,199	120,995	5,904	57,571	287,855	14,246
Steelhead	37,958	379,545	11,386	22,460	224,600	6,737	60,418	604,145	18,123
Total	158,107	2,715,830	128,197	86,982	1,353,670	62,994	245,089	4,069,500	191,191
Trap nets:									
Chinook	710	17,750	887	2,275	56,875	2,844	2,985	74,625	3,731
Steelhead	440	4,400	132	803	8,030	241	1,243	12,430	373
Total	1,150	22,150	1,019	3,078	64,905	3,085	4,228	87,055	4,104
Seines:									
Chinook	24,752	618,800	30,940	63,782	1,594,550	79,727	88,534	2,213,350	110,667
Blueback	3,500	17,500	875	2,444	12,225	611	5,944	29,725	1,486
Steelhead	16,720	167,200	4,816	43,978	439,780	13,193	60,698	606,980	18,009
Total	44,972	803,500	36,631	110,204	2,046,555	93,531	155,176	2,850,055	130,162
Gill nets:									
Chinook	252,044	6,301,325	312,563	226,053	5,759,050	281,470	478,097	12,060,375	594,033
Blueback	27,623	139,115	4,751	17,218	86,090	3,044	44,841	225,205	7,795
Steelhead	16,472	164,720	5,090	15,970	159,700	4,785	32,442	324,420	9,875
Total	296,139	6,605,160	322,404	259,241	6,004,840	289,299	555,380	12,610,000	611,703
Wheels:									
Chinook	15,182	379,550	12,867	6,876	171,900	6,978	22,058	551,450	19,845
Blueback	140,090	700,450	23,090	51,064	230,322	9,260	191,154	930,772	32,350
Steelhead	6,329	63,290	2,043	1,480	14,800	484	7,809	78,090	2,527
Silver	4,500	31,500	630	2,540	16,780	503	7,040	48,280	1,133
Total	166,101	1,174,790	38,630	61,960	433,802	17,225	228,061	1,608,592	55,855
Dip nets and squaw nets:									
Chinook	2,291	57,283	1,146	1,360	34,000	510	3,651	91,283	1,656
Blueback	16,910	84,550	1,841	8,112	40,560	608	25,022	125,110	2,449
Steelhead	1,145	11,450	229	509	5,090	77	1,654	16,540	306
Silver	5,142	35,994	540	3,175	22,225	333	8,317	58,219	873
Total	25,488	189,277	3,756	13,156	101,875	1,528	38,644	291,152	5,284
All apparatus:									
Chinook	381,756	9,544,133	466,872	340,669	8,624,450	421,882	722,425	18,168,583	888,754
Blueback	221,495	1,108,475	38,899	103,037	490,192	19,427	324,532	1,598,667	58,326
Steelhead	79,064	790,605	23,696	85,200	852,000	25,517	164,264	1,642,605	49,213
Silver	9,642	67,494	1,170	5,715	39,005	836	15,357	106,499	2,006
Total	691,957	11,510,707	530,637	534,621	10,005,647	467,662	1,226,578	21,516,354	998,299

D.—*Table showing by apparatus the number, weight, and value of each species of salmon taken in the Columbia River in 1890.*

Apparatus and species.	Oregon.			Washington.			Total.		
	No.	Pounds.	Value.	No.	Pounds.	Value.	No.	Pounds.	Value.
Pound nets:									
Chinook	104, 099	2, 602, 475	$78, 491	71, 346	1, 783, 659	$53, 510	175, 445	4, 386, 125	$132, 001
Blueback	50, 493	252, 465	5, 048	42, 097	210, 485	4, 209	92, 590	462, 950	9, 257
Steelhead	51, 600	516, 000	5, 160	41, 412	414, 120	4, 140	93, 012	930, 120	9, 300
Total	206, 192	3, 370, 940	88, 699	154, 855	2, 408, 255	61, 859	361, 047	5, 779, 195	150, 558
Trap nets:									
Chinook				3, 629	90, 725	2, 721	3, 629	90, 725	2, 721
Blueback				303	1, 515	30	303	1, 515	30
Steelhead				2, 979	29, 790	298	2, 979	29, 790	298
Total				6, 911	122, 030	3, 049	6, 911	122, 030	3, 049
Seines:									
Chinook	10, 750	268, 750	8, 063	53, 752	1, 343, 800	41, 402	64, 502	1, 612, 550	49, 465
Blueback	2, 250	11. 250	225	14, 292	71, 460	1, 425	16, 542	82, 710	1, 650
Steelhead	9, 013	90, 130	901	36, 701	367, 010	3, 669	45, 714	457, 140	4, 570
Total	22, 013	370, 130	9. 189	104. 743	1, 782, 270	46, 496	126, 758	2, 152, 400	55, 685
Gill nets:									
Chinook	369, 196	9, 229, 700	288, 730	211, 675	5, 366, 675	166. 167	580, 871	14, 596, 375	454, 897
Blueback	81, 909	409, 545	8, 440	25, 718	138, 590	2, 884	107, 627	548, 135	11, 324
Steelhead	29, 593	295. 935	3, 819	18, 635	186, 350	2, 467	48, 228	482, 285	6, 286
Total	480, 698	9, 935, 180	300, 989	256, 028	5, 691, 615	171, 518	736, 726	15, 626, 795	472, 507
Wheels:									
Chinook	83, 202	2, 080, 053	62, 401	27, 972	699, 317	20, 979	111, 174	2, 779, 370	83, 380
Blueback	529, 646	2, 648, 155	79, 444	207, 298	1, 036, 465	30, 431	736, 944	3, 684, 620	109, 875
Steelhead	71, 239	712, 390	16, 474	13, 801	138, 010	2, 322	85, 040	850, 400	18, 796
Silver	4, 660	31, 612	749	1, 500	10, 500	210	6, 160	42. 112	959
Total	688, 747	5, 472, 210	159, 068	250, 571	1, 884, 292	53, 942	939, 318	7, 356, 502	213, 010
Dip nets and squaw nets:									
Chinook	5, 021	125, 534	1, 958	2, 242	56, 068	841	7, 263	181, 602	2, 799
Blueback	32, 748	163, 740	2, 450	7. 717	38, 585	579	40, 465	202, 325	3, 029
Steelhead	11, 000	110, 000	1, 650	1, 402	14, 025	210	12, 402	124, 025	1, 860
Silver	10, 180	71, 260	1, 068	4, 500	31, 500	472	14, 680	102, 760	1, 540
Total	58, 949	470, 534	7. 126	15, 861	140, 178	2, 102	74, 810	610, 712	9. 228
All apparatus:									
Chinook	572, 268	14, 306, 512	439, 643	370, 616	9, 340, 235	285, 620	942, 884	23, 646, 747	725, 263
Blueback	697, 046	3, 485, 155	95, 607	297, 425	1, 497, 100	39, 558	994, 471	4, 982, 255	135, 165
Steelhead	172, 445	1, 724. 455	28, 004	114, 930	1, 149, 305	13, 106	287, 375	2, 873, 760	41, 110
Silver	14. 840	102, 872	1, 817	6, 000	42, 000	682	20, 840	144, 872	2, 499
Total	1, 456, 599	19, 618, 994	565, 071	788, 971	12, 028, 640	338, 966	2, 245, 570	31, 647, 634	904, 037

E.—*Table showing by apparatus the number, weight, and value of each species of salmon taken in the Columbia River in 1891.*

Apparatus and species.	Oregon.			Washington.			Total.		
	No.	Pounds.	Value.	No.	Pounds.	Value.	No.	Pounds.	Value.
Pound nets:									
Chinook	108, 983	2, 724, 575	$108, 983	94, 624	2, 365, 600	$94, 594	203, 607	5, 090, 175	$203, 577
Blueback	22, 988	114, 940	2, 298	52, 164	260, 840	5, 336	75, 152	375, 780	7, 634
Steelhead	54, 080	540, 800	7, 029	44, 448	444, 464	6, 308	98, 528	985, 264	13, 337
Total	186, 051	3, 380, 315	118, 310	191, 236	3, 070, 904	106, 238	377, 287	6, 451, 219	224, 548
Trap nets:									
Chinook	630	15, 750	630	712	17, 800	712	1, 342	33, 550	1, 342
Blueback	148	740	15	....	....	....	148	740	15
Steelhead	786	7, 860	118	501	5, 010	75	1, 287	12, 870	193
Total	1, 564	24, 350	763	1, 213	22, 810	787	2, 777	47, 160	1, 550
Seines:									
Chinook	16, 489	412, 225	16, 489	48, 596	1, 214, 900	36, 884	65, 085	1, 627, 125	53, 373
Blueback	2, 252	11, 260	225	8, 325	41, 625	1, 221	10, 577	52, 885	1, 446
Steelhead	5, 092	50, 920	919	27, 469	274, 690	5, 467	32, 561	325, 610	6, 386
Silver	857	5, 999	190	....	....	....	857	5, 999	190
Total	24, 690	480, 404	17, 823	84, 390	1, 531, 215	43 572	109, 080	2, 011, 619	61, 395
Gill nets:									
Chinook	448, 500	11, 212, 500	447, 031	208, 633	5, 341, 525	208, 593	657, 133	16, 554, 025	655, 624
Blueback	25, 679	131, 395	4, 102	15, 268	76, 340	2, 589	40, 947	207, 735	6, 691
Steelhead	17, 274	172, 740	3, 541	20, 581	205, 815	3, 468	37, 855	378, 555	7, 009
Silver	285	1, 995	60	694	4, 858	145	979	6, 853	205
Total	491, 738	11, 518, 630	451, 734	245, 176	5, 628, 538	214, 795	736, 914	17, 147, 168	669, 529
Wheels:									
Chinook	23, 645	591, 153	17, 735	9, 621	240, 540	7, 216	33, 266	831, 693	24, 951
Blueback	80, 004	400, 020	12, 000	36, 675	183, 375	5, 502	116, 679	583, 395	17, 502
Steelhead	27, 053	270, 530	6, 675	11, 536	115, 360	3, 460	38, 589	385, 890	10, 135
Silver	4, 920	34, 440	933	2, 730	19, 110	573	7, 650	53, 550	1, 506
Total	135, 622	1, 296, 143	37, 343	60, 562	558, 385	16, 751	196, 184	1, 854, 528	54, 094
Dip nets and squaw nets:									
Chinook	2, 943	73, 591	1, 119	403	10, 083	151	3, 346	83, 674	1, 270
Blueback	30, 436	152, 182	2, 388	13, 887	60, 918	914	44, 323	213, 100	3, 302
Steelhead	7, 459	74, 590	1, 149	2, 016	20, 164	302	9, 475	94, 754	1, 451
Silver	10, 370	72, 591	1, 089	4, 260	29, 820	447	14, 630	102, 411	1, 536
Total	51, 208	372, 954	5, 745	20, 566	120, 985	1, 814	71, 774	493, 939	7, 559
All apparatus:									
Chinook	601, 190	15, 029, 794	591, 987	362, 589	9, 190, 448	348, 150	963, 779	24, 220, 242	940, 137
Blueback	161, 507	810, 537	21, 028	126, 319	623, 098	15, 562	287, 826	1, 433, 635	36, 590
Steelhead	111, 744	1, 117, 440	19, 431	106, 551	1, 065, 503	19, 080	218, 295	2, 182, 943	38, 511
Silver	16, 432	115, 025	2, 272	7, 684	53, 788	1, 165	24, 116	168, 813	3, 437
Total	890, 873	11, 072, 796	634, 718	603, 143	10, 932, 837	383, 957	1, 494, 016	28, 005, 633	1, 018, 675

F.—*Table showing by apparatus the number, weight, and value of each species of salmon taken in the Columbia River in 1892.*

Apparatus and species.	Oregon.			Washington.			Total.		
	No.	Pounds.	Value.	No.	Pounds.	Value.	No.	Pounds.	Value.
Pound nets:									
Chinook	127,627	3,191,675	$127,627	89,852	2,246,300	$89,852	217,479	5,537,975	$217,479
Blueback	99,602	498,010	10,010	191,222	956,110	19,122	290,824	1,454,120	29,132
Steelhead	112,661	1,126,610	16,899	76,998	769,980	11,549	189,659	1,896,590	28,448
Total	339,890	4,816,295	154,536	358,072	3,972,390	120,523	697,962	8,788,685	275,059
Trap nets:									
Chinook	530	13,250	530	20	500	20	550	13,750	550
Blueback	240	1,200	24				240	1,200	24
Steelhead	879	8,790	132	150	1,500	150	1,029	10,290	282
Total	1,649	23,240	686	170	2,000	170	1,819	25,240	856
Seines:									
Chinook	27,707	689,535	20,686	27,582	689,550	20,687	55,289	1,379,085	41,373
Blueback	48,347	237,735	7,132	75,031	375,185	11,256	123,378	612,920	18,388
Steelhead	18,544	185,352	3,707	34,843	348,430	6,969	53,387	533,782	10,676
Silver	1,428	10,000	300				1,428	10,000	300
Total	96,026	1,122,622	31,825	137,456	1,413,165	38,912	233,482	2,535,787	70,737
Gill nets:									
Chinook	355,715	8,892,870	355,715	223,197	5,715,675	223,167	578,912	14,608,545	578,882
Blueback	94,141	470,705	9,714	21,021	110,105	3,303	115,162	580,810	13,017
Steelhead	37,043	370,430	5,866	33,428	334,280	5,090	70,471	704,710	10,956
Silver				714	5,000	150	714	5,000	150
Total	486,899	9,734,005	371,295	278,360	6,165,060	231,710	765,259	15,899,065	603,005
Wheels:									
Chinook	45,964	1,149,115	34,474	16,705	417,630	12,529	62,669	1,566,745	47,003
Blueback	314,585	1,572,923	47,187	145,766	728,832	21,865	460,351	2,301,755	69,052
Steelhead	95,654	956,540	28,696	45,056	450,560	13,517	140,710	1,407,100	42,213
Silver	39,255	274,785	8,234	4,872	34,104	1,023	44,127	308,889	9,257
Total	495,458	3,953,363	118,591	212,399	1,631,126	48,934	707,857	5,584,489	167,525
Dip nets and squaw nets:									
Chinook	1,356	33,900	509	578	14,450	217	1,934	48,350	726
Blueback	59,023	295,109	4,427	15,380	76,900	1,154	74,403	372,009	5,581
Steelhead	6,780	67,802	1,017	2,890	28,900	434	9,670	96,702	1,451
Silver	12,386	86,703	1,301	4,850	33,950	510	17,236	120,653	1,811
Total	79,545	483,514	7,254	23,698	154,200	2,315	103,243	637,714	9,569
All apparatus:									
Chinook	558,899	13,970,345	539,541	357,934	9,084,105	346,472	916,833	23,054,450	886,013
Blueback	615,938	3,075,682	78,494	448,420	2,247,132	56,700	1,064,358	5,322,814	135,194
Steelhead	271,561	2,715,524	56,317	193,365	1,933,650	37,709	464,926	4,649,174	94,026
Silver	53,069	371,488	9,835	10,436	73,054	1,683	63,505	444,542	11,518
Total	1,499,467	20,133,039	684,187	1,010,155	13,337,941	442,564	2,509,622	33,470,980	1,126,751

The number and location of the salmon canneries operated on the Columbia River in the years 1889 to 1892 were as follows:

Location.	1889.	1890.	1891.	1892.	Location.	1889.	1890.	1891.	1892.
Oregon:					Washington:				
Astoria	8	8	8	8	Ilwaco	1	1	1	1
Clifton	1		1	1	Knappton			1	1
Maple Dell	1	1	1	1	Chinook	1	1	1	1
Warrendale	1	1	1	1	Pillar Rock	1	1	1	1
Dalles	1	1	1	1	Brookfield	1	1	1	1
Celilo		1		1	Waterford	1	1	1	1
Portland*				1	Eureka	1	1	1	1
					Cathlamet	1	1	1	1
Total	12	12	12	14	Bay View	1	1	1	1
					Eagle Cliff	1	1	1	1
					Total	9	9	10	10
					Grand total	21	21	22	24

* This cannery, on the Willamette River, received its fish from the Columbia River.

The proportion of each species of salmon in the salmon pack of the Columbia River from 1889 to 1892 is shown in Table G:

G.—*Table showing by species the salmon pack of the Columbia River from 1889 to 1892.*

States and species.	1889.		1890.		1891.		1892.	
	Cases.	Value.	Cases.	Value.	Cases.	Value.	Cases.	Value.
Oregon:								
Chinook	140, 741	$844, 446	196, 414	$1, 138, 787	222, 963	$1, 279, 092	214, 631	$1, 244, 500
Blueback	15, 979	90, 628	53, 351	268, 104	10, 859	58, 816	51, 106	287, 984
Steelhead	11, 692	49, 899	26, 608	106, 432	15, 584	62, 236	45, 403	181, 612
Silver							4, 176	20, 880
Total	168, 412	984, 973	276, 373	1, 513, 323	249. 406	1, 400, 144	315, 316	1, 734, 976
Washington:								
Chinook	125, 956	755, 736	139, 190	807, 300	130, 944	759, 474	129, 636	751, 888
Blueback	1, 818	10, 423	3, 994	21, 965	4. 623	25, 426	15, 441	84, 925
Steelhead	13, 699	58, 688	16, 217	64, 868	13, 980	55, 920	26, 945	107, 280
Silver								
Total	141, 473	824, 847	159, 401	894, 133	149, 547	840, 820	172, 022	944, 093
Total for river:								
Chinook	266, 697	1, 600, 182	335, 604	1, 946, 087	353, 907	2, 038, 566	344, 267	1, 996, 388
Blueback	17. 797	101, 051	57, 345	290, 069	15, 482	84, 242	66, 547	372, 909
Steelhead	25, 391	108, 587	42, 825	171, 300	29, 564	118, 156	72, 348	288, 892
Silver							4, 176	20, 880
Total	309, 885	1, 809, 820	435, 774	2, 407, 456	398, 953	2, 240, 964	487, 338	2, 679, 069

In 1893 the pack of chinook salmon amounted to 290,000 cases.

The extent to which the different species of salmon enter into the pack, and the variations in the proportions during the four years covered by the figures, are shown in the following table. It appears that in 1892 the percentage of chinook salmon canned was less and that of each of the other species greater than in any of the preceding years.

Percentage of each species of salmon in the salmon pack of the Columbia River from 1889 to 1892.

Species.	1889.	1890.	1891.	1892.
Chinook	86. 06	77. 01	88. 71	70. 64
Blueback	5. 74	13. 16	3. 88	13. 65
Steelhead	8. 20	9. 83	7. 41	14. 85
Silver				. 86
Total	100. 00	100. 00	100. 00	100. 00

In discussing the data furnished by the foregoing tables and others which will follow, I will confine myself to the chinook salmon for the following reasons:

1. It is the most important species considered economically.
2. It is taken equally by all forms of apparatus.
3. Active fishing operations continue practically during the entire period of its sojourn in the river, and it is therefore the species which would be the first to feel the influence of excessive fishing.

These considerations do not apply with equal force to the other species, viz, the steelhead, the blueback, and the silverside, which are taken under similar conditions and at present constitute about one-fourth of the entire pack.

The spawning run of the steelhead takes place before fishing operations have begun on the river.

The spawning run of the silverside takes place after canning operations are concluded for the season, while the small size of the blueback gives it comparative immunity from capture by the gill nets, which take much the larger part of the king salmon.

Referring to Table G we find that the pack of the chinook or king salmon on the Columbia River in the years 1889, 1890, 1891, 1892, and 1893 was as follows:

	No. of cases.
1889	266,697
1890	335,604
1891	353,907
1892	344,267
1893	290,000

Or an average of 318,095 cases per annum.

In the previous five years, beginning with 1884, the pack of salmon, consisting almost entirely of chinook, was as follows:

	No. of cases.
1884	620,000
1885	553,800
1886	448,500
1887	356,000
1888	372,477

Or an average of 470,155 cases per annum.

It will be seen that in the five years beginning in 1884, the average pack per season was 152,060 cases in excess of the average pack of the five-year period beginning in 1889. During the latter period the amount of netting in use had been greatly increased, the fishing season extended, and the movement of the salmon into and up the river more completely intercepted.

Undoubtedly, for the reasons above stated, the proportion of the entire run of salmon caught was larger in the latter than in the former period of five years, which suggests that the decrease of salmon in the latter period compared is probably larger than is indicated by the difference in the average catch. There is no reason to doubt that this decrease is due to and inherent in the conditions under which the salmon fisheries of the river are now prosecuted, and that it will continue progressively so long as these conditions continue.

The lower average of the pack during the five-year period ending with 1893 is due to conditions interfering with and limiting natural reproduction during the period of 1884 to 1888, when access to the head waters was not impeded to the extent it now is by the fishing operations. The influence of the more effective exclusion of the salmon from their breeding-grounds for the last five years is yet to be disclosed. The seed for the harvest of the present year was sown in 1888 or 1889. What the extent of the harvest will be depends upon the opportunity that was afforded in these years for the salmon to reach their spawning-grounds.

For the ensuing five years we are powerless to influence conditions. What the production will be has been already determined, so far as we can influence it either by the regulation of the fisheries or by artificial propagation. There is every reason to apprehend that for the five years to come the average production of king salmon will be lower even than the average for the five years just passed. This is the penalty

that must be paid for the improvidence and total disregard of the conditions necessary to maintain supply which has characterized the operations of the salmon fishermen on the Columbia River.

ARTIFICIAL PROPAGATION OF SALMON ON THE COLUMBIA RIVER.

In 1888 the U. S. Fish Commission, by direction of Congress, established a salmon-hatching station on the Clackamas River, Oregon. The work done is given in the following table:

Statement showing the number of Quinnat salmon eggs collected and fry distributed from Clackamas Station since its organization by the U. S. Fish Commission to the close of the fiscal year 1893.

Fiscal year—	Eggs collected.	Eggs distributed.	Fry distributed.
1888-89	4,500,000		4,500,000
1889-90	4,314,000	1,000,000	2,766,475
1890-91	5,860,000	700,000	4,902,000
1891-92	2,036,000		1,332,400
1892-93	4,444,000		4,100,000
Total	21,154,000	1,700,000	17,600,875

NOTE.—The fry were all deposited in the Clackamas River. The 1,700,000 eggs were furnished to the Oregon fish commission and the fry produced were deposited in the Clackamas River.

This work was undertaken on the urgent solicitation of those concerned in the salmon fisheries of the Columbia River, who realized that their fisheries were being exhausted, and it was hoped that some compensation for the deficiency in natural reproduction could be made by artificial stocking and breeding. It is certain that this work has exercised some conservative influence upon the catch. It is doubtful, however, whether it has been on a sufficiently extensive scale to compensate for the damage resulting from the interference with natural reproduction by the operation of the fisheries.

THE FISHING-GROUNDS.

On the accompanying charts, the locations of the fishing-grounds resorted to by the fishermen using different kinds of apparatus are indicated, and the number and position of the fixed appliances operated in 1892 are shown.

The fishing-grounds of the Lower Columbia extend from the mouth of the river to Kalama. The apparatus employed consists of gill nets, pound nets, and haul seines.

The greater number of pound nets are located in Baker Bay, on the Washington side of the river and on the outside of Sand Island. They are not, however, confined to this region, but are located at every point of vantage on both sides of the river, from the mouth up to Kalama, a distance of 80 miles.

The haul seines are located either on the shores or flats, wherever a desirable location can be found.

The principal region of gill-net fishing extends from the mouth of the river to Cathlamet Bay, and covers, practically, the entire river outside of the limits of the pound nets. Other important areas of gill-net fishing are in Cordell channel, in the channel and back of the islands opposite Pillar Rock and Brookfield, and in the long reach of river from Puget Island to Eagle Cliff. Minor fishing operations are

conducted between Kalama and the Cascades, both in the river and its tributaries, such as the Willamette, the Cowlitz, etc. The fishing operations on the Upper Columbia, from the Cascades to the mouth of the Deschutes River, are conducted almost exclusively with salmon wheels, which are turned by the force of the current. These, when properly located and operated, constitute most effective engines of capture.

A careful examination of the charts giving the number and location of the different fishing apparatus will show how effectually the salmon are embarrassed or intercepted in their attempts to reach their spawning-grounds. It is not a matter of wonder that, under existing conditions, there has been a serious deterioration in the value of these fisheries. It is, indeed, a matter of surprise that any salmon have been able to elude the labyrinth of nets which bar their course to the Upper Columbia. It is hardly an exaggeration to state that the entire volume of this great river is strained through the meshes of the innumerable nets which occupy and obstruct every passageway to the spawning-grounds. It is certain that the continuation of these fisheries under present conditions will eventually result in rendering them unremunerative. It concerns alike the whole people of the State, as well as those directly interested in the fisheries, that such regulations of the times, methods, and apparatus of these fisheries should be established and enforced as are necessary to maintain supply.

THE FISHING SEASON.

It is a wise policy on the part of the State to encourage the largest catch that can be permitted consistent with maintenance of supply; to impose no unnecessary embarrassments or restrictions upon the enterprise of the fishermen, yet at the same time to insist upon such protective regulations and restraints as may be found necessary to prevent the serious impairment of an important industry by the operations of the fishermen. The fishermen themselves, who have such important interests at stake and the security and profit of whose large investments depend upon the maintenance of the salmon supply, should be prompt to propose and vigilant to enforce such regulations as may be necessary to this end. The nature of the protective regulations which can be enforced with the least restraint or embarrassment to the salmon fisheries and the canning industries is indicated by reference to the following table, showing by months the number and weight of each species of salmon taken for canning on the Columbia River.

Table showing by months the number and weight of each species of salmon utilized for canning purposes on the Columbia River in 1889, 1890, 1891, and 1892.

Years and months.	Chinook salmon.		Blueback salmon.		Steelhead salmon.		Silver salmon.		Total.	
	Number of fish.	Gross weight.	Number of fish.	Gross weight.	Number of fish.	Gross weight.	Number of fish.	Gross weight.	Number of fish.	Gross weight.
		Pounds.		*Pounds.*		*Pounds.*		*Pounds.*		*Pounds.*
1889—April	89,266	2,231,650	36,676	183,380	9,408	94,080			135,350	2,509,110
May	156,117	3,902,925	76,517	382,585	14,709	147,090			247,343	4,432,600
June	168,959	4,223,975	82,453	412,265	62,695	626,950			314,107	5,263,190
July	301,254	7,535,350	36,717	183,585	76,166	761,660			414,137	8,480,595
Total	715,596	17,893,900	232,363	1,161,815	162,978	1,629,780			1,110,937	20,685,495
1890—April	32,727	818,175	63,180	315,900	11,005	110,050			106,912	1,244,125
May	236,776	5,919,400	202,580	1,012,900	22,983	229,830			462,339	7,162,130
June	252,754	6,318,850	297,234	1,486,170	87,567	875,670			637,555	8,680,690
July	357,183	8,932,575	150,299	751,495	139,596	1,395,960			647,078	11,080,030
August	13,941	348,525	22,107	110,535	15,535	155,350			51,583	614,410
Total	893,381	22,337,525	735,400	3,677,000	276,686	2,766,860			1,905,467	28,781,385
1891—April	82,413	2,060,325	17,437	87,185	5,178	51,780			105,028	2,199,290
May	184,090	4,502,250	55,229	276,145	13,314	133,140			252,633	4,911,535
June	223,964	5,599,100	83,743	418,715	52,676	526,760			360,383	6,544,575
July	398,247	9,956,175	32,389	161,945	97,900	979,000			528,536	11,097,120
August	58,670	1,466,750	3,701	18,505	21,286	212,860			83,657	1,698,115
Total	947,384	23,584,600	192,499	962,495	190,354	1,903,540			1,330,237	26,450,635
1892—April	55,021	1,375,525	86,449	432,245	10,503	105,030			151,973	1,912,800
May	187,492	4,687,300	308,946	1,544,730	32,795	327,950			529,233	6,559,980
June	239,498	5,987,450	330,558	1,652,790	141,194	1,411,940			711,250	9,052,180
July	343,421	8,585,525	128,043	640,215	199,333	1,993,330			670,797	11,219,070
August	84,124	2,103,100	19,110	95,550	52,991	529,910			156,225	2,728,560
September					11,293	112,930	19,489	136,423	30,782	249,353
October					22,629	226,290	33,966	237,762	56,595	464,052
Total	909,556	22,738,900	873,106	4,365,530	470,738	4,707,380	53,455	374,185	2,306,855	32,185,995

In 1889 the fishing season extended from the 1st of April to the 31st of July. The total catch of chinook salmon amounted to 17,893,900 pounds, 87½ per cent of this amount being taken in May, June, and July, and 12½ per cent during the month of April.

In 1890 the fishing extended from April 10 to August 10, inclusive, and yielded a total product of 22,337,525 pounds of chinook salmon. Of this amount, 94½ per cent was taken in May, June, and July, and 1½ per cent during April and August.

In 1891 the fishing season extended from April 10 to August 10, inclusive, the total product of chinook salmon being 23,584,600 pounds, 85 per cent of which was taken in May, June, and July, and 15 per cent in April and August.

In 1892 the total catch of chinook salmon amounted to 22,738,900 pounds, and the fishing season extended from April 10 to August 10, and during September and October; 85 per cent of the total catch was made in the months of May, June, and July; 15 per cent in April and August; none in September or October.

It will be evident from the percentages given above, and by reference to the table, that the most productive fishing operations for the pound-net and gill-net region of the river are during the months of May, June, and July. The number of chinook salmon taken in April and August is relatively small, and under conditions not so profitable, either to the canneries or the fishermen, as those carried on during the months of May, June, and July. The April run of this salmon, if allowed to pass without interruption to the headwaters of the Columbia and its tributaries, would spawn in those waters, and the present productive capacity of the river would be increased to such an extent as to much more than compensate for the restrictions imposed by the prohibition of the fishery operations during the month of April.

The August run of chinook salmon consists of gravid fish near their spawning time. The flesh for this reason has undergone deterioration, and if canned constitutes an inferior product, the sale of which will discredit the reputation which the Columbia River salmon justly hold in public estimation. None of the August run of chinooks probably ascends the Columbia above the Dalles. They spawn in the tributary streams of the Lower Columbia and in the main stream between the Dalles and the mouth of the river.

RECOMMENDATIONS.

Having in view the considerations above presented, there can be no doubt of the necessity of restrictive regulations to maintain the salmon fisheries of the Columbia River. The enactment and enforcement of such regulations as may be necessary to this end is the prerogative of the States occupying the Columbia River basin. There is no precedent for the exercise by the General Government of control over the fisheries of our interior waters, except in so far as the forms of apparatus in use might be regarded as obstructions or impediments to navigation.

Whether the power to regulate the fisheries of interstate and bounding territorial waters is vested in the General Government or in the States is a subject which has provoked, and will continue to provoke, controversy until the respective rights and powers of individual States and the General Government are duly ascertained and defined by the courts of last resort. Having reference, however, to the interests of the fisheries, there is no doubt that these interests would be best subserved by uniform and concurrent regulations covering the entire region in which any special fishery is prosecuted.

In the case of the Columbia, we find that the great market fisheries for the salmon are prosecuted in the lower river, and the immediate evident advantage is to those who are engaged in the capture of the salmon or in canning them for the market. On the other hand, the nurseries for the young salmon, upon the abundance of which depend the productiveness and profit of the fisheries in the lower river, are in the remote tributaries and sources of the river in Washington, Oregon, and Idaho.

Regulations and restrictions of the net fisheries, so as to permit a reasonable number of salmon to reach their spawning-ground in the upper rivers, and protection of the salmon in these waters during their spawning season, in September and October, present the conditions to be fulfilled to keep up supply, so far as this can be accomplished by legal restraints.

To effectively restrain or regulate the net fisheries requires the concurrent action of the States of Washington and Oregon. Effective protection to the salmon on their spawning-grounds can be established only by concurrent action on the part of Washington, Oregon, and Idaho establishing a close season during the months of September and October. Here a serious difficulty arises. On the one hand it will be urged by the net fishermen of Washington and Oregon that any restraint on their operations will be burdensome to them without any corresponding advantage, since the fish they permit to escape their nets will be taken in the head waters to which they go before they have had an opportunity to spawn, and so they will be subject to serious losses and inconvenience without any compensating advantage. On the other hand, the citizens of eastern Washington and Oregon and of remote Idaho will be reluctant to impose any restraints on their own people in reference to the taking of salmon, for the reason that any increase in the fishery arising thereby will inure solely to the benefit of the fishermen between the Dalles and the mouth of the river.

The necessity of concurrent action on the part of the States occupying the Columbia River Basin, and of their cordial coöperation in measures necessary to maintain the salmon fishery of the Columbia River and to improve it, is evident from a consideration of the facts presented. The investigations of the U. S. Fish Commission in the Columbia River Basin made under the instructions of Congress clearly indicate that there is a serious deterioration in the product and value of the salmon fisheries of this river; that this deterioration is to be attributed in large part, if not entirely, to the exclusion of the salmon from their spawning-grounds by the operations of the net fishermen, and that artificial propagation on an adequate scale to compensate for the waste of the fisheries is no longer possible under existing conditions of the fisheries.

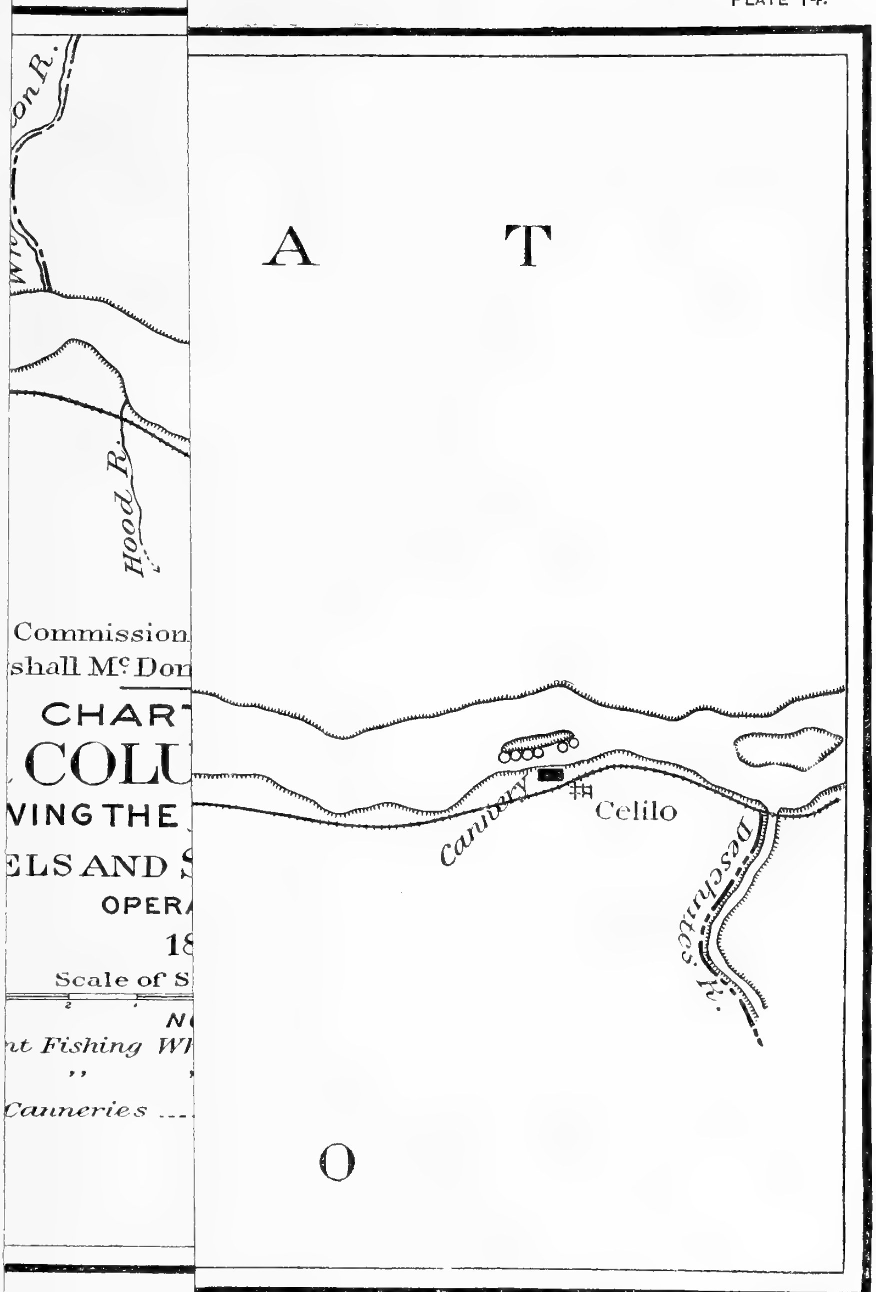
The initial step in attempting the restoration of the salmon fishery is to restrict and regulate the net fishing. The restriction that may be put in force with the least hardship to the fishermen is the shortening of the season of net fishing.

The use of pounds, gill nets, traps, and seines in the lower river, from the Cascades to the mouth, should be limited strictly to the months of May, June, and July. The wheels should not be permitted to take salmon prior to the middle of May, so as to permit the salmon which have entered the river in April the opportunity to pass up to the head waters. A further closed season for wheels should be established from the 1st of August to the 10th of September, so as to provide for the uninterrupted spawning of the August run of salmon. There does not at present appear sufficient reason to prohibit the wheel fishing during the balance of September and during the month of October. Protection for the salmon which have thus been enabled to reach their spawning-grounds should be afforded by a close season during the months of September and October, covering the streams in Washington, Oregon, and Idaho to which the salmon resort for breeding.

Should the policy above outlined be adopted by these States and the requisite measures to carry it into effect be enacted and enforced, it will be possible for the U. S. Fish Commission and the State commissions to greatly enlarge their fish-cultural operations, and to prosecute them under much more satisfactory and economical conditions than at the present time. Until the States interested adopt measures to restrain net fishing, so as to permit a portion at least of the salmon entering the river to pass up to their spawning-grounds, it is not deemed wise or expedient to attempt to increase or extend the work of artificial propagation of the salmon.

All efforts will be disappointing, unprofitable, and nugatory so long as the fisheries continue under existing conditions, and I would recommend, therefore, that no further steps be taken at present looking to the establishment of additional salmon-breeding stations in the Columbia River Basin.

MARSHALL MCDONALD,
U. S. Commissioner of Fish and Fisheries.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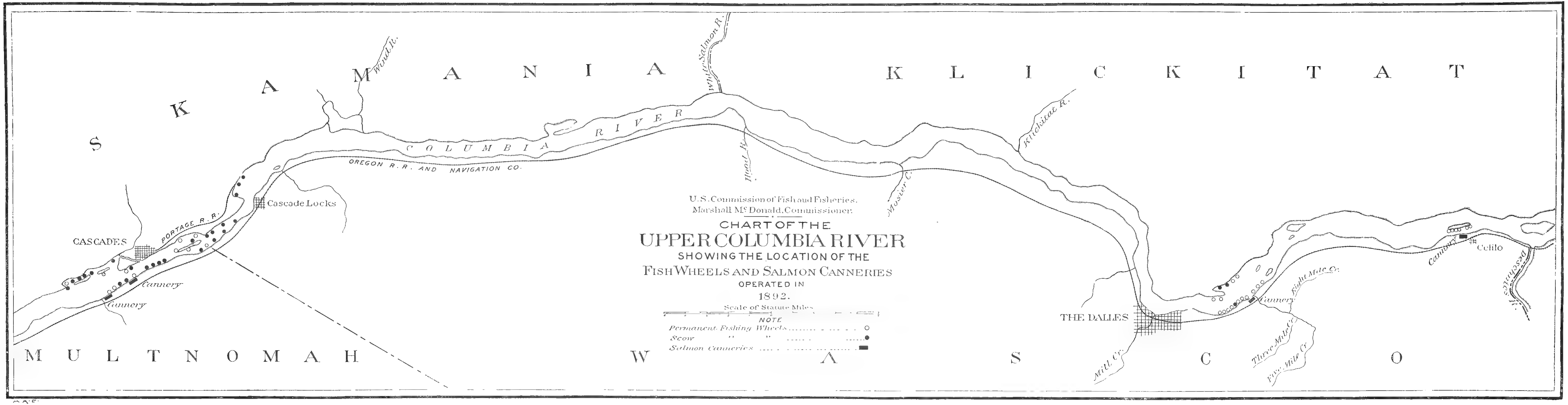
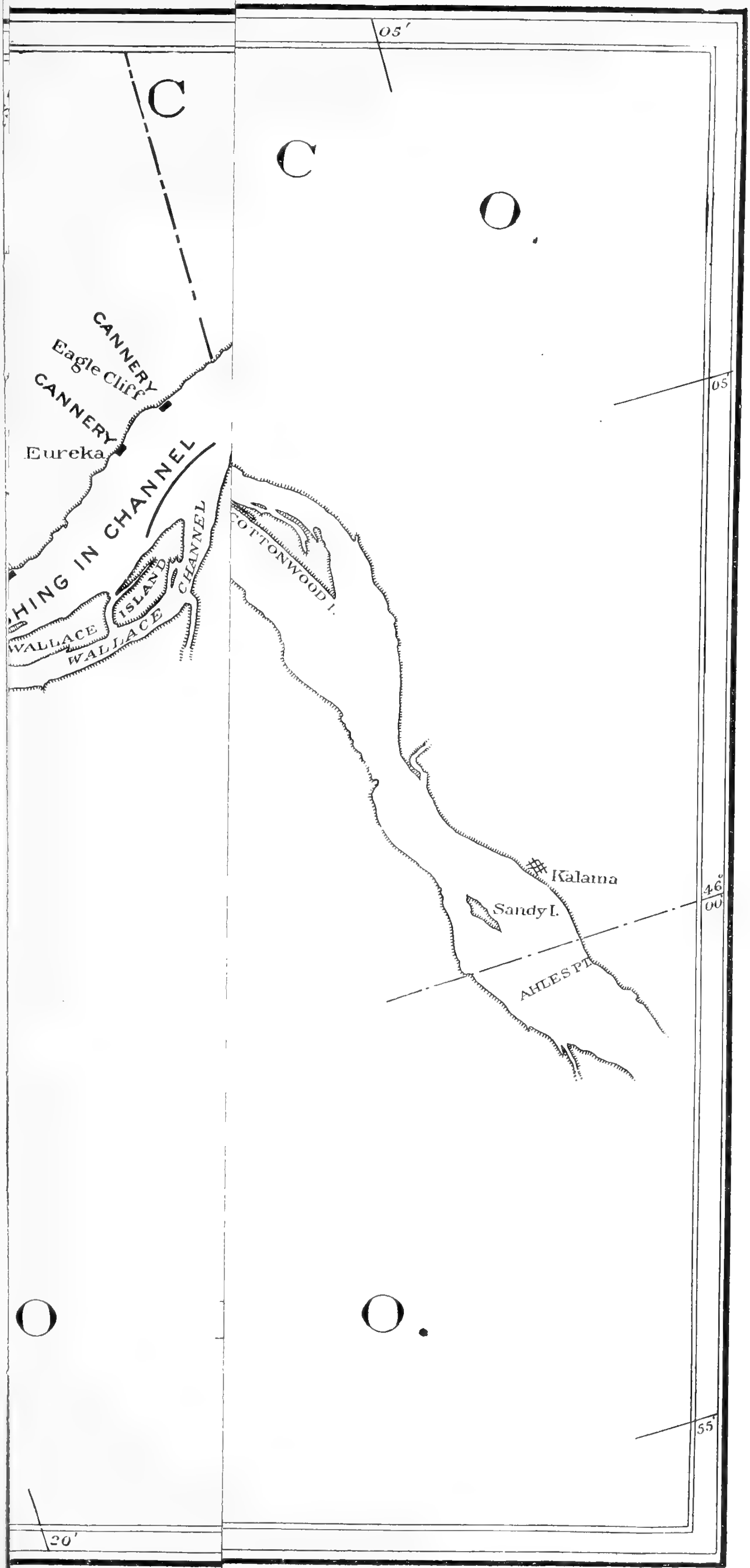

U. S. Commission of Fish and Fisheries.
Marshall McDonald, Commissioner.
CHART OF THE
UPPER COLUMBIA RIVER
SHOWING THE LOCATION OF THE
FISH WHEELS AND SALMON CANNERIES
OPERATED IN
1892.
Scale of Statute Miles
NOTE
Permanent Fishing Wheels
Scow " "
Salmon Canneries
S K A M A N I A
K L I C K I T A T
M U L T N O M A H
W A S C O
COLUMBIA RIVER
OREGON R. R. AND NAVIGATION CO.
PORTAGE R. R.
Wind R.
White Salmon R.
Hood R.
Mosier C.
Klickitat R.
Cascade Locks
CASCADES
Cannery
Cannery
THE DALLES
Mill Cr.
Three Mile Cr.
Five Mile Cr.
Eight Mile Cr.
Cannery
Cannery
Celilo
Deschutes R.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CANNERY
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COTTONWOOD I.
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20′


U.S. Commission of Fish and Fisheries.
Marshall McDonald, Commissioner.
CHART OF THE
LOWER COLUMBIA RIVER
SHOWING THE LOCATION OF
SALMON APPARATUS, FISHING GROUNDS
AND CANNERIES
IN
1892
Scale of Statute Miles
Scale of Nautical Miles
NOTE
Pound nets indicated thus
Weirs
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Gillnet Grounds
Canneries
PACIFIC CO.
WAHKIAKUM CO.
COWLITZ CO.
CLATSOP CO.
COLUMBIA CO.
PACIFIC
OCEAN
SALMON GILL-NET GROUNDS
SALMON GILLNETS
SALMONGILL-NET FISHING IN CHANNEL
GRAYS BAY
CANNERY
NORTH HEAD
CAPE DISAPPOINTMENT
SAND ISLAND
CLATSOP SPIT
PT. ADAMS
TONGUE PT.
ASTORIA
5 CANNERIES
SMITHS PT.
YOUNGS BAY
TANSY PT.
PT. ELLICE
CLIFF PT.
GRAYS PT.
Knappton
Pillar Rock
Brookfield
Bay View
PUGET ISLAND
TENASILLAHEE I.
CATHLAMET CHANNEL
Westport
Waterford
Eureka
Eagle Cliff
GRIMS ISLAND
FISHERS ISLAND
BIG SLOUGH
Walkers I.
Mt. Coffin
Monticello
COWLITZ R.
Kalama
Sandy I.
Rainier
JOHN DAY PT.
CATHLAMET BAY
WOODY ISLAND CHANNEL
LONG ISLAND
12400'
124°00'
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123°00'

A REPORT UPON INVESTIGATIONS IN THE COLUMBIA RIVER BASIN, WITH DESCRIPTIONS OF FOUR NEW SPECIES OF FISHES.

BY

CHARLES H. GILBERT, *Professor of Zoology, Leland Stanford Junior University,*

AND

BARTON W. EVERMANN, *Ichthyologist of the U. S. Fish Commission.*

INTRODUCTION.

The investigations upon which this report is primarily based were provided for by two items in the sundry civil bill, approved August 5, 1892. The first of these items authorized the expenditure, from the appropriation for inquiry respecting food-fishes, of the sum of $2,000, or so much thereof as may be necessary, "in examining the Clarke's Fork of the Columbia River, with the view to ascertain the obstructions which prevent the ascent of salmon in said river to the Flathead Lake and adjacent waters." The second item provided "for investigation and report respecting the advisability of establishing a hatching station at some suitable point in the State of Washington, $1,000, or so much thereof as may be necessary."

The purposes of these two investigations were very intimately related. Any inquiry regarding obstructions which might interfere with the movements of salmon in any of the tributaries of the Columbia would have a bearing upon the advisability of establishing a salmon-hatchery at any point in that river basin. These two inquiries were therefore conducted as one, and the results are presented in a single report.

This work was begun in September, 1892, by Dr. Charles E. Gorham, engineer and architect of the Commission, assisted by Mr. Barton A. Bean, of the U. S. National Museum, and Mr. A. J. Woolman, teacher of science in the high school at South Bend, Ind. Dr. Gorham died before the completion of the investigation, and Prof. Evermann was instructed by the Commissioner to continue the work during the summer of 1893. While carrying on these investigations he had the assistance of Drs. Charles H. Gilbert, Oliver P. Jenkins, and W. W. Thoburn, and Mr. Cloud. Rutter, all of Leland Stanford Junior University. The work was taken up by us at Pocatello, Idaho, August 2, it having been determined to include an examination of the obstructions in Snake River and a preliminary study of the natural-history features of the upper waters of the Columbia basin, with special reference to the present or former occurrence of salmon in those streams.

To expedite matters as much as possible in the limited time which could be given to the work, the force was divided into two parties at Pocatello. Gilbert, Thoburn, and Rutter were instructed to go down Snake River, examine the various falls in that stream, make investigations as to the physical and natural-history characteristics of as many of the tributary streams as possible, and then carry on similar inquiries along the Columbia from Idaho to the Lower Columbia. Evermann and Jenkins went up the Snake River to Idaho Falls, where the rapids were examined, and then proceeded to Sand Point, Idaho, where was begun the examination of Clarke Fork or the Pend d'Oreille River, the latter being the name by which this river is generally known in that region. The Pend d'Oreille River was examined throughout the entire distance from Sand Point to within a few miles of the international boundary line. The two parties came together at Spokane. From this point Evermann returned east, and the work was continued by Gilbert, Jenkins, Thoburn, and Rutter.

Investigations were made at various points in the Lower Columbia basin, chiefly for the purpose of selecting a site for a salmon hatchery and for gaining information respecting the occurrence and abundance of salmon in the various streams tributary to the Lower Columbia.

While carrying on the investigations regarding the obstructions to the free movement of salmon in these rivers and the selection of a salmon-hatchery site, considerable opportunities occurred for a study of the natural history of the salmon and the general natural-history features of the waters of the Columbia basin. Considerable valuable information was obtained regarding the former as well as the present distribution of salmon in this region.

Large collections of fishes were made at the various places where collecting was possible, and their study has greatly increased our knowledge of the variations in and the geographic distribution of the fresh-water fishes of the northwestern United States.

In this report we give (1) detailed descriptions of the various streams visited by the different members of the party; (2) a list of the species of fishes obtained in the Columbia River basin, together with a discussion of their relationships and distribution; (3) notes on the breeding colors of the whitefish (*Coregonus williamsoni*), by Barton A. Bean; and (4) an annotated list of the reptiles and batrachians obtained.

The time which has been given to the study of the various problems pertaining to the salmon question has been wholly inadequate to a satisfactory understanding of the matter, and any views which we venture to give in this paper must be regarded as tentative. An exhaustive study of the natural history of the various species of salmon and trout of the Columbia has never been made. The investigations now in progress will, it is confidently expected, lead to a much better understanding of the questions involved.

LIST OF STREAMS EXAMINED.

The following is a classified list of the streams examined, together with the dates upon which the various places were visited:

Snake River: President Camp, Wyoming, August 14, 1891 (Evermann and Jenkins); Idaho Falls, August 4 and 5 (Evermann and Jenkins); American Falls, August 5 (Gilbert); Shoshone Falls, August 6 (Gilbert); Twin Falls, August 6 (Gilbert); Auger Falls, August 7 (Gilbert); Blue Lakes, August 7 (Gilbert); Upper and Lower Salmon Falls, August 7 (Gilbert); Mouth of Boise River, Caldwell, Idaho, August 8 (Gilbert, Thoburn, and Rutter); Payette, Idaho, August 10, and Lewiston, Idaho, August 15 (Gilbert, Thoburn, and Rutter).

Ross Fork of Snake River, near Pocatello, Idaho, August 4 (party).

Port Neuf River, Pocatello, August 2 (Evermann and Rutter) and August 3 (party).

Mink Creek near Pocatello, August 3 (party).

Little Wood River near Shoshone, August 5 (Thoburn and Rutter).

Boise River near Caldwell, August 8 (Gilbert, Thoburn, and Rutter).

Payette River at Payette, August 9 (Gilbert, Thoburn, and Rutter).

Clearwater River near Lewiston, August 15 and 16 (Gilbert, Thoburn, and Rutter).

Potlatch Creek near Lewiston, August 16 (Gilbert, Thoburn, and Rutter).

Palouse River near Colfax, Washington, August 17 (Gilbert, Thoburn, and Rutter).

Grande Ronde River near La Grande, August 11 (Thoburn).

Pataha River at Starbuck, August 14 (Gilbert, Thoburn, and Rutter).

Pend d'Oreille River: Throughout the entire distance from Albany Falls, Idaho, to Big Eddy Cañon, near the international boundary line, August 9 to 15 (Evermann and Jenkins), and from its mouth to the international boundary, September 23 to 26, 1892 (Gorham and Bean).

Deer Lodge, Little Blackfoot, Big Blackfoot, Hell Gate, Bitter Root, Missoula, and Flathead rivers, together with many of their tributary streams, July and August, 1891 (Evermann and Jenkins).

Flathead Lake, August 1 to 4, 1891 (Evermann and Jenkins), and September, 1892 (Gorham and Woolman).

Thompson Falls, September, 1892 (Gorham, Bean, and Woolman).

Lake Pend d' Oreille at Sand Point, Idaho, August 7 (Evermann and Jenkins).

Upper Columbia River: Kettle Falls, August 16 (Evermann and Jenkins), and at the mouth of Pend d'Oreille River, September 23, 1892 (Gorham and Bean).

Colville River from Meyers Falls to its mouth, August 16 (Evermann and Jenkins).

Spokane River in the vicinity of Spokane, September, 1892 (Gorham and Bean), and August 18 to 21 (Evermann and Jenkins).

Little Spokane River below Dart's Mill, September, 1892 (Bean), and near Dart's Mill, August 18 (Evermann and Jenkins).

Cœur d'Alene River at Wardner, August 19, and Cœur d'Alene Lake at Cœur d'Alene, August 21 (Gilbert, Thoburn, and Rutter).

Hangman Creek near Spokane, September, 1892 (Bean), and at Tekoa, August 18 (Gilbert, Thoburn, and Rutter).

Lower Columbia River: Pasco, Wallula, Umatilla, Dalles, Portland, and Astoria, August 11 to 27 (Rutter and Thoburn).

Walla Walla River near Wallula, August 23 (Thoburn and Rutter).

Mill Creek near Walla Walla, August 14 (Thoburn and Rutter).

Umatilla River near Pendleton, Oregon, August 12 (Gilbert, Thoburn, and Rutter), and at Umatilla, August 11 and 23 (Thoburn and Rutter).

Des Chutes River at its mouth, August 24 (Rutter).

Yakima River near North Yakima and Ellensburg, August 23 and 24 (Jenkins).

Natchess River near North Yakima, August 24 (Gilbert and Jenkins).

Cowlitz and Toutle rivers near Castle Rock, August 28 and 29 (Gilbert and Jenkins).

Newaukum River near Chehalis, August 28 (Gilbert and Jenkins).

Skookumchuck River near Centralia, August 27 (Gilbert and Jenkins).

Lake Washington at Seattle, June 25, 1892 (Evermann).

Snoqualmie River at Snoqualmie Falls, June 26 and 27, 1892 (Evermann).

INVESTIGATIONS WITH REFERENCE TO THE SELECTION OF A SITE FOR A SALMON HATCHERY IN THE STATE OF WASHINGTON.

Every stream and every point visited was considered with regard to its fitness for salmon-hatching purposes. The majority of the places are, however, not suited at all to such ends, and only such locations as seem to possess most or all the required physical and biological conditions need be treated in detail in this report.

LOWER COLUMBIA.

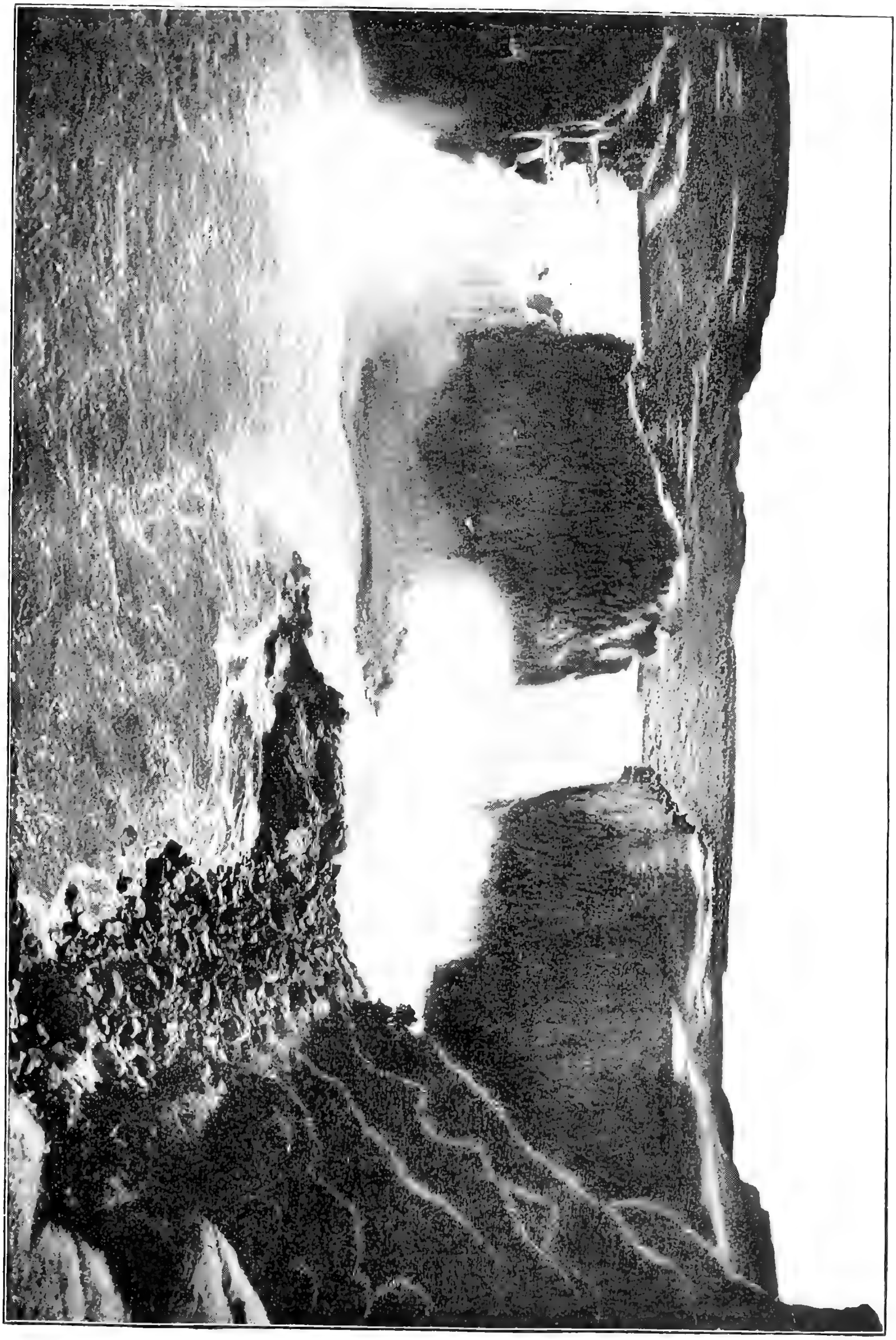
There are several reasons why a salmon hatchery would be better located on some tributary of the Lower Columbia rather than the Upper Columbia or the Snake. The supply of salmon would be more certain and the condition of the salmon better. So far as is known to us, salmon which enter the Columbia in the spring pass by the mouths of the lower tributaries and press on higher up the stream. It is probably these fish which arrive in the Upper Snake in the vicinity of Glen's Ferry and Salmon Falls in the latter part of August and in September. All observers on the Upper Snake agree that they arrive at this time and spawn from September 1 on to October or November. The fish of the fall run enter the Columbia a short time only before they are ready to spawn. So far as we now know, the most of these turn directly into streams near the mouth of the river and spawn a short time after their entrance into the Columbia.

A second point in favor of such a location for a hatchery would be, perhaps, that the young fish when turned into the stream would stand a better chance of reaching salt water than they would if they had the whole course of the river to traverse. during which time they are exposed to the attacks of all their fresh-water enemies.

A third point in favor of such a location is the accessibility of various points in Washington along the lower course of the Columbia.

Two streams were selected for examination, the Yakima River and the Cowlitz. Both of these rise in the high mountain region of southwestern Washington, and receive their waters largely from the snows of Mount Ranier, Mount Adams, and Mount St. Helen. They run through regions very different in their physical characteristics and in their climate. The Yakima lies to the east of the Cascade range and runs down through a dry valley covered with sagebrush and devoid of trees, except along the immediate vicinity of the stream itself. The summer season is very hot and the winter correspondingly cold. So far as the character of the stream itself is concerned, it seems admirably adapted for a hatchery. At North Yakima the stream is perfectly clear, flows rapidly in an open valley over gravel and sand, and had a temperature of 64° August 23. It receives an important tributary, the Natchess, 1 mile above the town. At its mouth this stream is about 75 feet wide with an average depth of 2 feet, and with a current of 1½ feet per second. The temperature was 57½° at 9:30 a. m. Were other conditions favorable, no better stream could be found for a hatchery than the Natchess.

While salmon used to ascend the Yakima and its tributaries in large numbers, they have greatly fallen off of late years. It is now very doubtful whether a hatchery located at any point on this stream could depend for spawn on the fish which ascend



TWIN FALLS, SNAKE RIVER. TOTAL DESCENT ABOUT 180 FEET.

the stream itself. If it were considered desirable to ship spawn to such a hatchery, the Natchess might be favorably considered.

In considering the possibility of establishing a hatchery on the Yakima or its tributaries, it should be borne in mind that the stream flows through a wide valley, only partially under cultivation. Extensive canals are now being constructed with a view to irrigating the entire valley. Recent litigation seems to show that more water has been claimed on behalf of these canals than the stream will be able to furnish. It seems probable, therefore, that the entire supply will be withdrawn from the river during the summer and fall.

Toutle River.—The Toutle River is a tributary of the Cowlitz. Near its mouth, near Castle Rock, an excellent site for a salmon hatchery can be found. This is a beautiful, clear, and cold stream, furnishing an abundance of water, which is never likely to be required for other purposes. The temperature of the water at 11 a. m. August 27 was 59.5°. The Toutle is a natural spawning-ground for the salmon, which still come into it in large numbers. They could be taken in the deeper pools in gill nets, and the character of the stream is such as to permit seining. The time at our disposal did not permit us to make a very thorough investigation of this stream and entirely prevented our visiting the Upper Cowlitz. From what we saw, however, we are inclined to recommend the Toutle River as being the best suited for hatchery purposes of any stream in Washington.

THE UPPER COLUMBIA.

Near Kettle Falls, Wash.—The Colville River flows into the Columbia at the town of Kettle Falls, about 2 miles below the Kettle Falls of the Columbia. An abundance of excellent water can be obtained from the Colville River, and plenty of suitable land can probably be had for nothing, as the people there are much interested in securing the hatchery. This site is about 2 miles from Meyers Falls, a station on the Spokane and Northern Railroad. The only objection to it is the uncertainty of getting a sufficient number of spawning salmon conveniently near.

As already stated, salmon were abundant in the Columbia at Kettle Falls as late as 1878. Since then there has been a great decrease. They have been scarce since about 1882; since 1890 there have been scarcely any at Kettle Falls. The Meyers brothers say they have been almost unable to buy any salmon for their own table from the Indians for three years. Certain Indians with whom we talked at Kettle Falls said salmon were once very abundant there, but that very few are seen now. Other persons testified to the same effect. Essentially the same information was obtained regarding the decrease of salmon in other parts of the upper tributaries of the Columbia, viz, at Spokane, in both the Big and Little Spokane rivers, and in the Snake River and its various tributaries.

On the Little Spokane River, near Spokane, Wash.—This river, as elsewhere stated in this report, possesses all the natural conditions necessary for this purpose; and it has the advantage of having excellent shipping facilities in the numerous railroads centering at Spokane. The uncertainty of being able to obtain spawning salmon in sufficient numbers is, however, a fatal objection to this point, unless shipping the eggs from the Lower Columbia might be regarded as feasible.

SNAKE RIVER IN SOUTHWESTERN IDAHO.

If the station does not necessarily have to be in Washington, a very good site can be found on Snake River in Idaho near Salmon Falls. Salmon seem still to ascend to that point in considerable numbers. For detailed description of this place see below.

SUMMARY.

In summing up the facts brought out by these investigations it may be said, first, that the absence of salmon from the Pend d'Oreille River is not necessarily due to the presence of falls in that stream, but to other causes, chief among which is the excessive catching of salmon in the Lower Columbia; second, that while it is true that the salmon are shut out by falls and dams from a large area, especially in the Upper Snake River basin, and that these limitations are increasing as the streams become useful for irrigation and mining purposes, it is nevertheless certain that the decrease in the salmon has been even greater and that the accessible waters suitable for spawning purposes are still more than ample to meet present needs; and, third, that the desirability of establishing another salmon hatchery at some point in the Columbia basin will depend largely upon the nature of the fishery legislation in the States of Washington, Oregon, and Idaho.

It must be understood, however, that our knowledge regarding the present abundance of salmon, their relative abundance as compared with former years, and the location and extent of their spawning-grounds, is of the most general kind. While valuable so far as it goes, the information which we now possess upon these important questions is chiefly useful in indicating the nature of the investigations which must be carried on for several seasons before a thorough understanding of the salmon question can be reached.

DETAILED ACCOUNT OF THE VARIOUS WATERS EXAMINED.

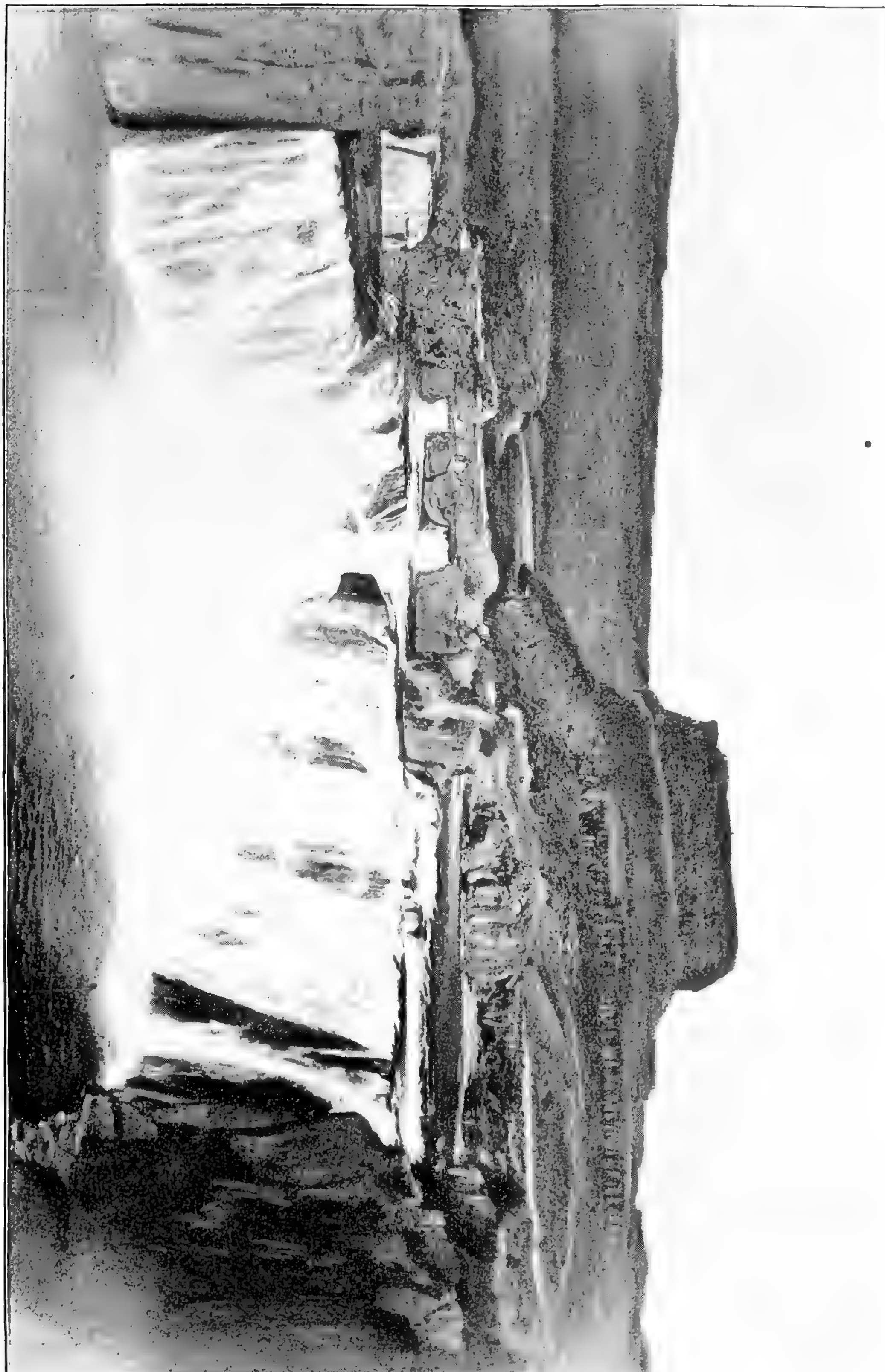
SNAKE RIVER.

This river has been visited by us at the following points: President Camp, near the southern boundary of the Yellowstone Park; Idaho Falls; American Falls; Shoshone Falls; Twin Falls; Auger Falls; Blue Lakes; Upper and Lower Salmon Falls; at mouth of Boise River; at Caldwell, Payette, and Lewiston. The observations made at these various places are here given in order, beginning with the point farthest upstream which was visited.

President Camp.—Snake River here flows through a wide meadow, grassy and open on the right side, but covered with a heavy growth of chapparal on the other. It is here a beautiful river with clear, cold water and gravelly bottom. The banks in the immediate vicinity of the camp are low, not exceeding 3 or 4 feet. In the main stream the current was pretty strong, but there are quiet nooks and coves where there was considerable water vegetation. The temperature of the water at 9 a. m., August 14, was 62.5°. Fishes were found to be abundant here, the red-horse sucker (*Catostomus ardens*), dace (*Rhinichthys cataractæ dulcis*), chubs (*Leuciscus hydrophlox* and *Leuciscus lineatus*), whitefish (*Coregonus williamsoni*), cut-throat trout (*Salmo mykiss*), and the blob (*Cottus bairdi punctulatus*) being the species thus far known from the Snake River at that point.*

Idaho Falls, Idaho, August 4 and 5, 1893.—At this point the river has cut its channel through the immense lava bed of that region. The banks of the stream are abrupt or vertical but broken and jagged walls of lava, reaching in some places as many as 15 to 20 feet or more above the surface of the water. Large, detached masses of lava are frequent in the stream, and in the banks or bounding walls are many immense potholes, by far the largest and finest we have ever seen. The river is here confined to a relatively narrow channel, through which it rushes in a series of foaming rapids. There

* See Evermann: Explorations in Montana and Wyoming, Bull. U. S. Fish Comm. for 1891, 22.



SHOSHONE FALLS, SNAKE RIVER. TOTAL DESCENT ABOUT 210 FEET.

are many comparatively quiet nooks, however, in the broken, irregular walls, and the water is very deep, perhaps 20 to 50 feet. While these rapids are quite turbulent, trout and even other species of fishes have no trouble in ascending them. Trout (*Salmo mykiss*) are common here, and in a large race which has been cut through the lava for milling purposes we obtained many specimens of dace, chubs, and suckers (*Catostomus ardens*).

American Falls, Idaho.—At American Falls the Snake River is about 750 feet wide and flows but little below the general surface of the country. The shores have no abrupt banks, the northern shore only being followed by a low, rounded bluff 100 to 200 feet high. This was apparently composed of gravel, as no lava could be seen projecting from it. The outline of the American Falls is very irregular. Its position is determined by a basaltic ledge crossing the river. The position of the edge of this ledge is now marked by a series of islands, between which the river flows and below which it falls. This same ledge can be traced for some distance along the edge of the cañon below the falls and is there seen to be underlaid by a layer of sandstone. At the falls, however, this seems not to be the case, the rock being lava from top to bottom. The western end of the falls is probably 200 to 300 yards farther upstream than the eastern end. The front of the falls is located, therefore, very obliquely to the course of the stream. They show nowhere any great vertical height, 15 feet being probably near the maximum. In several places the falls are so broken down as to present only a short stretch of steep rapids, with gentler rapids above and below. Below the falls the water becomes immediately deep, but the rapids above are, at the stage of water seen, extremely shallow. On the eastern side of the stream, especially, is a long stretch of these shallow rapids, in which the water averages not more than 6 inches deep, and it is here that the greatest obstacles to the ascent of fish would be found. When water is high in the spring, trout are seen to pass over the falls in large numbers, and it is probably true that even at a lower stage of water, as in the fall, fish can succeed in passing this obstacle. A fishway could be made here at very little expense were it considered desirable.

The stream here, as elsewhere in Idaho, flows through a country covered with sagebrush and the usual desert vegetation, bordered more or less thickly with willows. In the rapids at American Falls the rocks are thickly covered with green filamentous algæ, and among the rocks are found very numerously crawfish, caddis worms, and other suitable food for fish. At American Falls the river descends about 70 feet and enters a cañon, the surface of the country remaining about the same level, and from this point to below Shoshone Falls the stream descends deeper and deeper into its cañon by a succession of falls and rapids. It flows here through what is known as the "Lava Beds" of the Snake River, and the walls of its cañon are composed of successive lava flows. But few streams find their way into the Snake River from the mountains of the north. As will be seen from the map, the greater number of these on flowing down from the mountains sink into the lava and are lost. Of this kind are Birch Creek, Little Lost River, and Big Lost River. There is thus a great stretch of country bordering the river on the north entirely without surface water. Towards the west the Malade or Wood River is the first stream to find its way into the Snake from the north. The water which thus sinks near the base of the mountains apparently reappears inside the cañon of the Snake, coming out as great springs at the base of the cliffs. The best-known of these lie between the Shoshone Falls and Glen's Ferry. They emerge from the foot of the cliffs often as large streams and are used to irrigate the bottom lands which border the river on the north at that point.

The water of these streams is beautifully clear and cold; trout abound in them, and the smaller minnows run up from the Snake into them. Crawfish (*Astacus gambelii*) also are very abundant. The temperature of the streams averages about 60°, and they would be admirably adapted for hatchery purposes. The salmon visit this part of the river in sufficient numbers to furnish roe for hatching, and this is probably the most available point where suitable water and an abundance of fish can be found for such a station in Idaho.

Unnamed Falls.—The next falls in the course of the stream were not visited by any member of the party, as nothing was heard of them until we had passed that region. They seemed to be unnamed. According to Mr. J. L. Fuller, of Bliss, Idaho, the river has a vertical fall of about 40 feet a short distance above the mouth of Dry Creek, the latter a small stream coming in from the south, nearly midway between American and Shoshone Falls. Mr. Fuller worked a mining claim at the mouth of Dry Creek at one time, and is therefore well acquainted with the falls, which he states to be vertical and impassable to any kind of fish.

Shoshone and Twin Falls.—The great obstacles to the passage of salmon up the Snake are found in Shoshone and Twin Falls, both of which are vertical and of great height. The erection of fish-

ways to permit the passage of salmon seems wholly impracticable. Both Shoshone and Twin Falls are formed by layers of more compact and lighter colored lava, which the stream wears away with great difficulty. Shoshone Falls can be reached by a stage ride of 28 miles from the town of Shoshone, on the line of the Union Pacific. The cañon at this point is high and composed of black columnar basalt, which rises from the river's edge as vertical cliffs, estimated to be about 800 feet high. The falls are said to be 210 feet high. The middle of the falls is higher upstream than either end, giving it a somewhat horseshoe-shaped appearance, and the front of the falls is about 1,200 feet wide.

Twin Falls are 4 miles above Shoshone Falls and would be fully as serious an obstacle as the latter, even if fish were able to reach their foot. An island divides the stream here into two portions, both of which, however, fall nearly vertically a distance said to be 180 feet. On the north side of the stream the vertical portion of the falls is somewhat lower, the upper portion having worn back to form very strong rapids, through which no fish would be able to pass. We were not able to learn that salmon reached the foot of Shoshone Falls, although it is very probable that they do so. The stream immediately below the falls is deep and flows at the bottom of a very steep cañon, and even if the salmon were there and spawned in the bed of the stream, it might be difficult to detect them.

Four miles below Shoshone Falls is the first of the large springs already referred to. These rise near the northern shore of the river in what are known as Blue Lakes (see p. 177), and one of these springs forms a large river. The Snake River at this point has widened out and flows over a succession of shallows, and has a considerable expanse of bottom lands, which can be cultivated whenever water can be put upon them.

Auger Falls.—A gentleman living at Blue Lakes is of the opinion that salmon do not come above Auger Falls, which is found 4 miles below Blue Lakes. This was found to consist of a stretch of very strong rapids. At Auger Falls the river runs for a distance of at least 250 yards, hemmed in between basaltic walls, which vary in distance from 50 to 250 feet. As nearly as could be estimated, the stream falls in this distance about 50 feet, the last 20 feet of which is nearly vertical. In this entire stretch of 250 yards there is no resting-place for a fish, and the water dashes through it in whirls and eddies in such a way as to make it doubtful whether a salmon could sustain the long-continued effort necessary to pass the rapids. It is, however, certain that no single stretch of these so-called falls is insurmountable. Both salmon and sturgeon are frequently taken below Auger Falls, but apparently not above them. At Auger Falls it was estimated that the current averaged 15 feet a second. Marks on the rocks show that at high water the stream was at least 15 feet above the level seen at this time.

Upper and Lower Salmon Falls.—From Auger Falls down to Salmon Falls the valley of the Snake widens and the cliffs become broken down and more and more rounded, as though glaciated. On each side of the stream are found in places extensive deposits of water-worn gravel, which are washed for gold. At the Upper Falls the stream flows over another lava ledge, the southern end of the fall being farthest down stream, and is there broken down into rapids, which present no serious obstacle to the ascent of the fish. This is also the case at various points along the front of the falls. The maximum vertical descent is about 20 to 25 feet. Salmon are known to go over these falls in large numbers. Indians encamp yearly on the island immediately below the falls, and spear the fish as they pass over the ripples. Well-known spawning-beds are said to be in the river about 2 miles above the falls, and salmon are known to ascend Salmon Creek, a tributary entering 2 or 3 miles higher up. A white man has been in the habit of catching salmon with a seine each year, and could obtain more than he could find market for. It seems evident, then, that a hatchery located near this point and drawing water from one of the many large spring-fed streams which enter here would have no difficulty in securing fish.

The Lower Salmon Falls are about 6 miles below the Upper. We are informed that a man can descend this stretch of the stream in a small boat, although there are numerous shallow places and short rapids. The Lower Falls are very similar to the Upper. The river at this point falls over a lava shelf, for the most part vertically, and with a total descent of about 20 feet. The front of the falls is very wide, probably over a quarter of a mile, and runs obliquely, the northern end being farthest upstream. By far the greater part of the water falls over the southern half of the falls, so little coming over the northern part as to prevent the ascent of fish, except, perhaps, at one point. At the extreme southern end the falls are much lower. Here, and also near the center, the fish would apparently have no difficulty in ascending. To sum up what was learned about the salmon in this part of Snake River, it is certain that they visit Glen's Ferry and the stretch of the stream between

there and a point 2 or 3 miles above Upper Salmon Falls in large numbers, and spawn mainly in the bed of the stream, some of them entering Salmon Creek, as before said. It is not known to us how far they ascend towards Auger Falls from the Upper Salmon Falls. They appear late in August, and spawn in the bed of Snake River and the smaller tributaries from September on to November.

Snake River below the various falls.—A short distance below Shoshone Falls, as already indicated, the valley of the Snake changes its character. The bluff recedes, leaving the valley several miles wide in places, and becomes, at the same time, less abrupt, and the lava walls are often entirely concealed by slopes of water-worn gravel and soil. The valley varies in width, but preserves this general character as far as the town of Huntington. It is along the upper part of this widened valley that the extensive springs already mentioned are found. The first of these are at Blue Lakes. Here they rise in the bottom of a lake at the base of the basaltic cliffs which forms the cañon wall. The outlet of this lake, after running a short distance, widens into a second very deep lake, in which the water again sinks into the lava. This water, together with a much larger supply, reappears at a lower level as a very large spring, from which flows a small river of beautifully clear blue water. This finds its way among the lava bowlders down a rather gentle incline to the Snake. Farther down the valley at intervals appear other similar springs. The streams that flow from these are used to irrigate the bottom lands, which are naturally covered with sagebrush and other desert vegetation. On the application of water they become very fertile, raising large crops of alfalfa and other hay, of garden vegetables, and fruit. If the supply of salmon were assured, these springs would offer model sites for a hatchery. They are located from 6 to 10 miles above Bliss, Idaho, and are reached by good roads. The most extensive of these springs empty into the lower course of the Malade or Wood River, which empties into the Snake a short distance from Bliss.

The long stretch of the Snake River which lies between Huntington and Lewiston was not visited by any member of the party. The stream was described to us as flowing for the greater part of this stretch through a deep cañon in which were numerous rapids. A steamer once passed through this cañon at high water, but arrived at Lewiston so battered and broken that none has dared attempt the passage since. No falls occur along this stretch of the stream, and there is nothing that can be considered an obstruction to salmon. But this part of the country is almost uninhabited and the river is difficult of approach. At Lewiston and below, the stream flows again through a comparatively open country, the cañon walls being rounded and the slopes covered for the most part by deposits of water-worn gravel and soil. Mr. W. M. Stockton, of Glen's Ferry, Idaho, who has resided there twenty-three years, says that the Snake River is usually highest in June, falls until the winter rains set in, and is lowest in October. Salmon caught in large numbers at Glen's Ferry; speared. The run begins in September and lasts six weeks or two months. More numerous in former years than now, but plenty were caught last year, 1892. Indians spear them, salt and dry them for winter use. They spawn on the gravel beds in the river at and near Glen's Ferry in water so shallow that the dorsal fins are out of the water. Knows of no obstructions in the river below Salmon Falls. Has heard that Salmon Falls is an obstruction; does not know so. The sturgeon are caught at all seasons of the year; more numerous in summer. Has seen and caught salmon in Payette River and has seen them spawning there and in the Snake River on the ripples. The Boise is highest in June and lowest in October. Knows nothing definite about the redfish. Says they are a landlocked salmon. They are caught in Payette Lake and shipped to Caldwell and sold as food-fish during September.

TRIBUTARIES OF SNAKE RIVER.

Ross Fork of Snake River.—This is a small stream flowing into the Snake above Pocatello. It was examined on the Fort Hall Indian Reservation about 12 miles north of Pocatello. The stream there was about 15 feet wide, 10 inches deep, and had a very slow current—not over 6 inches per second, but somewhat swifter on the riffles. The water was somewhat muddy and the bottom of the stream was chiefly of mud, with gravel in some places. There was an abundance of *Nostoc* and other algoid vegetation in the water, and the banks were well covered with willows and small cottonwood bushes, but no large bushes of any kind. Fishes, including trout, were abundant in this stream, and it was here that the types of a new sucker (*Catostomus pocatello*) were obtained. The temperature of the water at 1 p. m., August 4, was 72.5°, when the air in the shade was 93°.

Port Neuf River.—This stream has its rise in southeastern Idaho, on the low divide which now separates the Salt Lake Basin from that of the Upper Snake River, and flows into the Snake a few miles west of Pocatello. At Pocatello this stream averages about 30 feet wide, 6 inches deep, and

flows about $1\frac{1}{2}$ feet per second. There are many deep holes or pools with mud bottom, while in the shallower reaches the bottom is of gravel and the current is more swift. The banks are usually low and of clay, with occasional rocky places. The water is rather clear and cool, the temperature being 76° at noon, August 2, when that of the air in the shade was 90°. There appeared to be very little algæ or other water vegetation in this stream. The banks were covered with a dense growth of willows, while back from the stream a short distance on either side are sagebrush plains.

A few dead bivalves (*Margaritana margaritifera*) were found, but molluscous life seems to be rare in this stream. Crawfish (*Astacus gambelii*) were found in considerable abundance. Not many species of fish were found here. By far the most abundant species is *Leuciscus hydrophlox*, the next most common are the western dace (*Rhinichthys cataractæ dulcis*) and the chub (*Leuciscus lineatus*). Suckers (*Catostomus catostomus*) and blobs (*Cottus philonips*) were also found, the latter in considerable numbers. No trout were seen here, but we were informed that they are sometimes taken in the river near Pocatello, and that they are found rather plentifully further up the stream. The temperature and other characters of the water are fairly suitable for trout, and no doubt plants of such fish would prove successful in this river.

Mink Creek.—This is a small stream flowing into the Port Neuf about 6 miles above Pocatello. Near its mouth it averages about 6 to 8 feet wide, 2 feet deep, and has a 2-foot current. The water at the time of our visit was pretty clear and the temperature 59° at noon, August 3, when that of the air in the shade was 92°. The bed of the stream was of mud and sand in the more quiet portions and of gravel on the riffles. The banks were overhung by a heavy growth of willows. This is a typical trout stream, and we found the cut-throat trout to be quite common. About the same species of minnows and suckers which were found in the Port Neuf at Pocatello were also found here. Crawfish, toads, frogs, and mussels were also obtained here.

The Port Neuf River at the mouth of Mink Creek is a clear, cool stream with gravel and lime-deposit bottom in the shallower parts and mud and sand where deeper and more quiet. The same species of fishes were obtained here as elsewhere in this river.

Salmon Creek.—The uppermost tributary of Snake River to which salmon have access is Salmon Creek, emptying into the river 3 or 4 miles above the Upper Salmon Falls. This was not visited by us, and little seems to be known about the general character of the stream. Mr. J. L. Fuller has seen salmon in the lower 2 or 3 miles of the stream, but does not know how far they ascend.

Malade River.—The next stream is the Malade or Little Wood River, already mentioned. This was fished near Shoshone by Messrs. Thoburn and Rutter, August 5. Width, 25 feet; depth, 3 feet; current, 2 feet; temperature at 7 a. m.: air, 70°; water, 62.5°. During dry seasons the Malade becomes dry for the lower 40 or 50 miles of its course and is prevented from being a salmon stream by inaccessible falls near its mouth. As seen by us in its lower course, it runs on the surface of the country until a point about 4 miles above its mouth. Here it leaves the surface and enters a narrow cleft in the rocks by a succession of falls and rapids, two of which are designated the Upper and the Lower Falls. This cleft in the rock soon deepens and widens into an extensive cañon, which seemed to be from 500 to 800 feet deep in its lower part. At the lower falls the stream descends vertically about 40 feet, shooting out of the cañon, which is here a mere cleft 20 to 30 feet wide, and falling into a deep pool at the bottom. As Mr. Fuller stated, it looks very much like the stream out of the spout of a teakettle. During high water the stream rises so as to obliterate these falls, and in the spring trout have no difficulty in ascending from the Snake into the Upper Malade. In autumn, however, these falls are an impassable obstacle to the salmon. It is below these falls that the large springs already referred to enter the Malade. These increase the size of the stream many times, so that even during the lowest stage of water in autumn the Lower Malade flows full—this even at times when the upper stream is entirely dry. According to Mr. Fuller, who based his statement upon the reports of engineers, the Lower Malade at its lowest stage is a stream averaging 7 feet deep, 72 feet wide, having a current 15 miles an hour. It descends rapidly in its lower course and would offer a fine site for a hatchery. Salmon are seen as far as the base of the Lower Falls, i. e., 2 or 3 miles above its mouth.

Bruneau River.—The next considerable tributary is the Bruneau, which enters from the south about opposite the town of Mountain Home. This was not visited by any member of the party. A large number of men were interviewed who were acquainted with the stream; these all agreed that it was a natural salmon stream. Mr. Fuller has seen the salmon spawning in the headwaters of the Bruneau, in October. Recently a dam has been placed in the lower course of the stream for irrigation purposes. The dam is without fishway, and salmon are now absolutely prevented from ascending.

Owyhee River.—The Owyhee River is a large stream rising in the mountains of Nevada and flowing into the Snake at the boundary between Idaho and Oregon, south of Huntington, Oreg. The salmon are said to enter this in quantity, and are well known to the miners on the headwaters of the stream. This is a river of much importance, to which nearly all the streams of northern Nevada are tributary.

Boise River.—Examined August 8, one mile west of Caldwell, Idaho. Width, 200 to 400 feet; depth, 2 to 5 feet; current, 2 feet; temperature of water at 10 a. m., 66°. The bed of this stream is mostly sandy, with occasional patches of gravel. There is a riprap dam about 2 miles above Caldwell, belonging to the Howard Sebree Company. The lower slope of this dam is about 6 feet, and there is no fishway.

Dr. J. B. Wright, of Caldwell, tells us that he caught salmon in the Boise, near Caldwell, in 1864, and that they were very numerous then. In 1865 placer mining began on the Upper Boise and but few salmon have been caught since. Occasionally he catches one in the upper waters of the Boise, but they are very rare. He further says that salmon trout enter this river in the spring, when the waters are high, and that he has caught them full of eggs in July in the Upper Boise. The dam already mentioned has been in five years, but he does not think it has affected the run of fish. Dr. Wright says that the salmon run up Snake River in September, the run lasting until the middle of October. He has not noticed any decrease in recent years. We were also told that at Glen's Ferry there is a run of salmon trout in April and May.

Payette River.—Examined August 9, three-fourths of a mile southeast of Payette, Idaho, near its mouth. Average width 360 feet; depth, 3 feet; current, 1½ feet; temperature of water, 63° at 5 p. m. Water clear; bottom sand and gravel. The Payette at this place is a rather shallow stream flowing rapidly over numerous shallows and much divided by gravelly islands. It flows over sand and coarse waterworn gravel. The river seems to be suitable for salmon, but no one in the vicinity seemed able to give us any notes of value as to their occurrence.

Salmon River.—This is, except the Snake, the largest and most important but certainly the least known river of Idaho. It has its headwaters in the mountains forming the divide between Montana and Idaho, and enters the Snake where the latter is passing through its deep cañon, near the northeast corner of Oregon. We were informed that the lower course of the Salmon River itself is through a deep narrow cañon, which renders it difficult of access. It is claimed that salmon still ascend this stream in large numbers, and spawn in all the little creeks high in the mountains. Little, however, is known with certainty regarding the salmon or other fishes of this stream.

Clearwater River.—Examined August 15 and 16 at various points from its mouth to 5 to 7½ miles above Lewiston, Idaho, to the mouth of Potlatch Creek. It is there a clear, cold stream flowing over very large round bowlders. This kind of bottom makes it almost impossible to use a net, and salmon could not be obtained by this method if the stream were otherwise suitable for a hatchery. The temperature of the water was 83.5° when the air was 83.5° at 4 p. m., and 63.5° when the air was 63° at 10 a. m. As in all of these larger, clear, cold streams, we found fishes very scarce. The smaller minnows and suckers could be obtained only at the rate of two or three to a haul. Fish may be more abundant in the deeper parts of the stream, or the numbers may be kept down by the trout, which could easily pursue the smaller fishes in the clear water.

Potlatch Creek.—This is a small stream flowing into the Clearwater, near Lewiston. It was examined August 16 near its mouth.

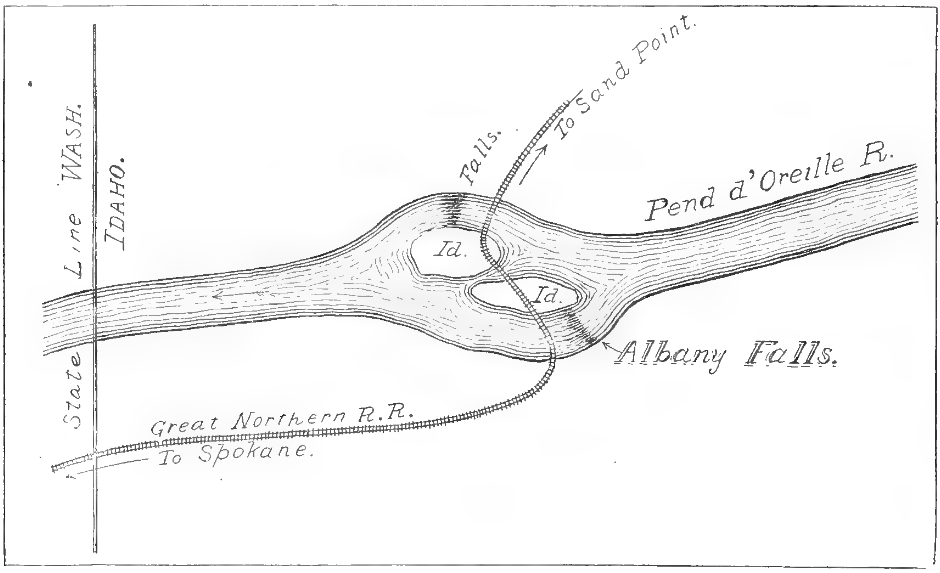
Palouse River.—This is a considerable stream rising in western Idaho and flowing westward through southeastern Washington to the Snake River north of Walla Walla about 45 miles. It was examined near Colfax, Wash., August 17. At this place the stream was quite low, being reduced to pools. Temperature of water 74°.

Grande Ronde River.—This river rises in eastern Oregon, flows northeast, and joins Snake River near the forty-sixth parallel. It was examined near La Grande August 11. According to Mr. J. B. Foley, of La Grande, salmon are very numerous in this river in September and October, coming as far as the dam 1 mile above La Grande. They try to jump this, but do not succeed. They are speared in large numbers by the Indians and boys, but are so worn and cut up by their trip up the river that they are of little value as food-fish. The dam is of logs with two 4-foot steps on the lower side, and has no fishway. There are no dams below—that is, between La Grande and the Snake River. Plenty of salmon trout come in the spring in April and May. These can get over the dam in high water. Water lowest in August and September. There is placer mining in the upper parts of the river, and the water is milky. Trout are plentiful at Meacham, in the upper Grande Ronde River, and in the side streams.

Pataha River.—This stream was examined at Starbuck August 14. Temperature at 4 p. m., 68°; air, 66°. Width, 50 feet; depth, 1 foot; current, 2 feet. The Pataha is of some importance and is well supplied with the common fishes of the region.

Pend d'Oreille River.—There are two important lakes which are drained by this river—Flathead Lake, in Montana, and Lake Pend d'Oreille, which is in Idaho, near the Washington State line. Examinations were made at Flathead Lake* in 1891 by Evermann and Jenkins, and in 1892 by Gorham and Woolman, who found the "falls" in Flathead River near the outlet of Flathead Lake to consist simply of a series of rapids, which do not interfere in the least with the free movements of fish. From this point down Flathead River possesses no falls or obstructions of any kind, and there is none in Clarke Fork until near Lake Pend d'Oreille.†

Not far above Lake Pend d'Oreille, in Clarke Fork proper, and near a station on the Northern Pacific called Thompson Falls, are some small rapids which are no more serious than are those in Flathead River. This is according to Dr. Gorham and Mr. Woolman. We did not deem it necessary to revisit these two places, as Dr. Gorham's notes and the information which we gained through conversations with a number of persons who were familiar with that part of the river convinced us that there are no obstructions of any importance above Lake Pend d'Oreille.



We examined this river pretty carefully from the outlet of Lake Pend d'Oreille to near its mouth, or where it joins the Columbia just across the British Columbia line. While that portion of the river above Lake Pend d'Oreille is still spoken of as Clarke Fork, the portion below Lake Pend d'Oreille is, in that region, known only as the Pend d'Oreille River. From Sand Point, Idaho, which is at the outlet of Lake Pend d'Oreille, to the Washington line is about 25 miles. In this portion of the river there is only one fall or rapid, and that is Albany Falls, sometimes known as Villard Falls or Seniaquoteen Falls. These falls are about 1½ miles above the little town of Newport, Idaho. The falls are divided by a small, rocky island, upon which is built one of the piers of the railroad bridge which is used by the Great Northern in crossing the river at this place.

The relative position of the bridge and the falls is shown in the above diagram.

These falls are scarcely more than pretty steep rapids and would not interfere at all with the ascent of salmon. The part to the left of the islands (going down stream) is just above the bridge.

* For information concerning the upper waters of this system see Evermann, in Bull. U. S. Fish Commission for 1891, pp. 1–90.

† In 1883 Mr. Livingston Stone, under the direction of the U. S. Commissioner of Fish and Fisheries, made an extended exploration of Clarke Fork and the Columbia River with reference to the selection of a suitable site for a salmon-breeding station. In Mr. Stone's interesting report (Report U. S. Fish Comm. for 1883, 237-255) is given much valuable information regarding the upper portion of Clarke Fork and the Big and Little Spokane rivers. He found, what our own inquiries confirm, that salmon never reach Lake Pend d'Oreille, but thought they were probably kept back by the falls at the mouth of the Pend d'Oreille.

At the time of our visit (August 9) the total descent was probably 10 feet, but as a rapid, not in a vertical fall. During low water the descent would be somewhat greater. The fall on the right side is of the same character and presents no greater difficulties.

Just below Albany Falls the river is perhaps 1,000 feet wide and 20 to 30 feet deep in the channel. The stream was up, however, at this time, and would probably fall at least 10 feet before reaching low-water mark, according to the captain of the *Dora*, a small steamer which makes irregular trips between Newport and the head of Box Cañon. On August 9 we took this steamer and went down the river to Box Cañon, a distance of about 60 miles, although the steamer people call it 80 miles. Throughout this distance the Pend d'Oreille is a beautiful, clear stream, with a good strong current, and varying in width from 500 to 1,000 feet.

Box Cañon is a narrow gorge about 1½ miles long. The walls are quite close together and the river rushes through the narrow passage with a very strong current. There is, however, no fall in the cañon and small boats have on several occasions been taken through without injury. There is nothing here to stop the ascent of salmon.

Metaline Falls.—These falls are just below the Metaline mining camp, or 7 miles below the foot of Box Cañon. The river between Box Cañon and Metaline Falls has a good strong current, but no falls or rapids. The falls are over a ledge of limestone, through which the river has cut, and are the largest and most important of any found in this river. The total fall is perhaps as much as 30 feet, but it is in a series of rapids, there being no vertical drop at all. The stream is here inclosed between high rocky walls and is very turbulent for some distance. Salmon could probably ascend these falls without much difficulty. A little blasting near the left (west) wall would make it still easier for fish to get up. Just above Metaline Falls, Sullivan Creek flows into the Pend d'Oreille from the right bank.

From Metaline we walked down the river about 14 miles farther, on August 10, to the head of what is known as the Big Eddy Cañon. This cañon is about 3 miles long and is quite narrow, the limestone walls being so close together that in one place a fallen tree lies across from one wall to the other. The river rushes through this cañon with great fury, but there are no falls, and we do not believe that the ascent of salmon would be seriously interfered with. If it should be shown that salmon can not swim against such a strong current for so great a distance, we see no easy way by which it could be made less difficult. There are some relatively quiet nooks or eddies here and there, however, in which salmon would be able to rest and we therefore do not consider Big Eddy Cañon a serious obstacle to the ascent of fish. Lime Creek, a small but fine trout stream, flows into the river at the head of this cañon.

The river between Metaline Falls and Big Eddy Cañon is quite swift, but contains no falls or rapids worth mentioning. The lower end of Big Eddy Cañon is but a short distance from the British Columbia line, just north of which the Pend d'Oreille turns abruptly westward and runs approximately parallel with the international boundary until it flows into the Columbia, a distance of about 27 miles from where it leaves the United States. We did not visit this part of the river for two reasons: (1) Dr. Gorham's notes and Mr. Bean's report upon the obstructions were sufficiently full to enable us to judge of its character; and (2) several persons familiar with it, and with whom we talked, all agreed that there are no obstructions *below* Big Eddy Cañon which are nearly as serious as Big Eddy Cañon or Metaline Falls. All agree that Metaline Falls is the most serious obstruction found anywhere in the Pend d'Oreille.

From Mr. Bean's report and from our conversations with prospectors and others living along the Pend d'Oreille, it appears that there is a series of rapids near the mouth of the river and another just above the mouth of Salmon River, which empties into the Pend d'Oreille just above the Washington line. These are all said to be rapids rather than falls and probably would not interfere with the ascent of salmon in the least. From the foregoing it therefore appears that there are no serious obstructions in Clarke Fork of the Columbia which would prevent salmon from reaching Lake Pend d'Oreille and Flathead Lake, or other parts of that river basin.

The Pend d'Oreille River is one of the most beautiful and picturesque in America. It is a magnificent river, probably averaging over 1,000 feet in width and being very deep throughout most of its course. In most places there is a good, strong current, becoming dangerous rapids in the narrower places. The water is clear and pure and cold—an ideal trout stream. The depth varies greatly, high water occurring in July from melting snows. Late in August or September the water is many feet lower than in July. High mountain slopes ascend abruptly from the river's banks throughout most of its course, and these are covered with a heavy evergreen forest and a dense growth of underbrush.

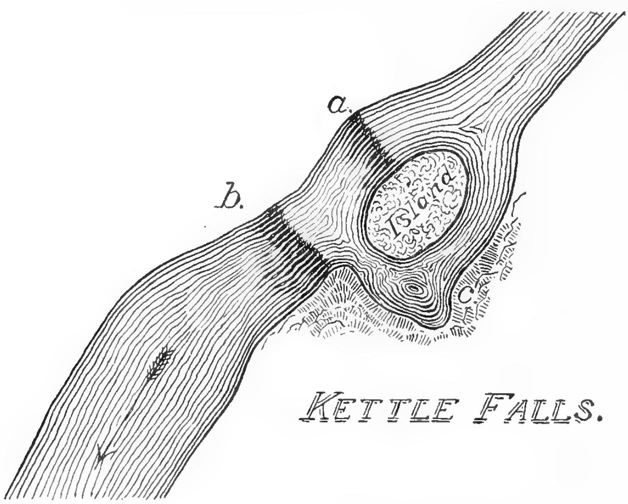
In other places, as at Usk, La Claires, and Metaline, the river bottom widens out and there are many acres of excellent farming land. During high water large areas of this level land are covered by water, but when the waters subside these tracts become valuable meadow lands.

Trout are abundant in this river; salmon trout are also quite abundant, and both bite readily. We know of no stream which offers finer opportunities for sport with the rod than the lower Pend d'Oreille. Deer, wild geese, and ducks were also seen in considerable numbers. From the Big Cañon below Metaline we were compelled to walk back to Newport, a distance of about 75 miles. As there was no trail for the greater part of this distance, except a cattle trail, which was used by cattle only later in the summer and which was now under water, we found the trip a very difficult one, attended by many hardships. We reached Newport early in the morning of August 15, where we took the train for Colville, Washington.

THE UPPER COLUMBIA RIVER.

The Upper Columbia River was visited only at Kettle Falls, Washington, but several of its tributaries were examined, notes upon which are given in the following pages.

Kettle Falls, about 9 miles from Colville, Washington, are the only falls in the Upper Columbia that need mentioning in this connection. At this place the river cuts through a ledge of highly crystalline rock, the strata of which have a gentle dip upstream. A large island divides the river into two parts, as shown in the following diagram:



At the present stage of water we judged these falls to have a vertical fall of 12 to 15 feet each, but they are not of equal height throughout their entire width. The upper falls (*a*) was at least 14 feet vertical near the island and in the middle, but toward the right bank it seemed to be lower and less vertical. The lower fall (*b*) is probably 15 feet high in its highest places, but at the right shore it, too, is not so high nor so nearly vertical. At *c* is a seething whirlpool, the water coming around the left side of the island, having to make an abrupt turn in order to get out. The upper fall is probably not of great importance in this connection, for, when salmon have once gotten above the lower falls they can go around to the right (going upstream) of the island where there are no serious obstructions, but they are seen to swim up over the upper falls. George E. and Jacob A. Meyers are two intelligent and well-informed men who have lived at Kettle Falls for 23 years, and are quite familiar with the falls and their relation to the salmon. From them we obtained the following information: Up to 1878 salmon were very abundant in this part of the Columbia; "millions were seen ascending the falls every season." The run would begin in June and continue until October, the biggest run being in the last half of August. The run toward the end of June was also large, but while there was

LOWER KETTLE FALLS, COLUMBIA RIVER.

a decrease in the number from then until late in the summer, some salmon were to be seen all along; so that there were not two distinct runs, but one continuous run from June to November with two periods of great numbers—June and August.

The salmon caught early in the season are regarded as the best. The salmon have no trouble getting up Kettle Falls; indeed, they usually swim right up the current, seldom having to jump out of the water. The time when it is hardest for them to get up is during a medium stage of water; it is easy at high water, as the fall is then wiped out to some extent; it is also easy at low water, as there are eddies and pools then in which the fish can rest.

Salmon formerly spawned in great numbers just below Kettle Falls. The spawning beds were toward the right side of the river on gravel bottom, usually just above a riffle. A great many spawned in the Colville River just below Meyers Falls.

The Colville flows into the Columbia from the east just below Kettle Falls a short distance. Meyers Falls is in the Colville 2 or 3 miles above its mouth. The height of the lower Meyers Falls is 80 feet, that of the upper about 26; the total descent, including rapids, being about 125 feet. The width of the falls is about 150 feet. Salmon still enter Colville River and spawn on the gravel beds below Meyers Falls, but they are very rare. A fishway could be placed here which would enable salmon to ascend the Colville, which is, so far as the other features are concerned, an excellent stream for salmon and trout.

The temperature of the water at the falls, August 16, was 62°.

While we think the evidence shows that salmon are able to ascend the Lower Kettle Falls, the evidence that they have ever gone much, if any, farther, is not conclusive. Indeed, one of the earliest accounts of these falls which we have seen, states positively that no salmon are taken above these falls. In volume IV of the Narrative of the United States Exploring Expedition under Captain Wilkes we find the following:

"The Kettle Falls are one of the greatest curiosities in this part of the country. They are formed by a tabular bed of quartz that crosses the river, and which, being harder than the rocks, either above or below, has of course suffered less by abrasion, and thus formed a basin that renders the name appropriate. The total descent of the water is 50 feet, though the perpendicular fall in no place exceeds 15 feet, which is, however, more than sufficient to prevent the passage of boats. At the foot of the falls the breadth of the river is 2,330 feet, and the rate of the current is 4 miles an hour. This breadth is somewhat narrowed by an island, about midway of which is the first fall, which is almost entirely unbroken. Thence the river forces its way over a rocky bed until it reaches the main fall, where the water is thrown into every variety of shape and form, resembling the boiling of a kettle, from which the falls derive their name.

"There is an Indian village on the banks of the great falls, inhabited by a few families, who are called "Quiarlpi" (Basket People), from the circumstance of their using baskets to catch their fish (salmon). The season for the salmon fishery had not yet [in June ?] arrived, so that our gentlemen did not see the manner of taking the fish; but as described to them, the fishing apparatus consists of a large wicker basket supported by long poles inserted into it and fixed in the rocks. The lower part, which is of the basket form, is joined to a broad frame, spreading above, against which the fish, in attempting to jump the falls, strike, and are thrown back into the basket. This basket, during the fishing season, is raised three times in the day (twenty-four hours), and at each haul, not unfrequently, contains 300 fine fish. A division of these takes place at sunset each day, under the direction of one of the chief men of the village, and to each family is allotted the number it may be entitled to; not only the resident Indians, but all who may be there fishing, or by accident, are equally included in the distribution.

"At the lower end of the falls are large masses of quartz rock, on which the Indians dry their fish. Few of the salmon, even if able to pass the lower fall, ever get by the upper one, being generally caught between the two falls; consequently, above this place no salmon are taken. A short distance below the Kettle Falls are the Thompson Rapids, which begin at the mouth of Mill River, and extend for some distance below that point."

This visit to Kettle Falls and eastern Washington was made by Captain Wilkes in 1841.*

Spokane River.—The Spokane River has its source in Cœur d'Alene Lake, in Kootenai County, Idaho. From the northern end of the lake the river flows approximately due west about 30 miles to

* Narrative of the United States Exploring Expedition, during the years 1838, 1839, 1840, 1841, and 1842; by Charles Wilkes, U. S. Navy, commander of the expedition. In five volumes. Vol. IV, pp. 444 and 445. Philadelphia, Lea & Blanchard, 1845.

the city of Spokane, where it turns to the northwest and flows into the Columbia, about 45 or 50 miles distant. The total length of the Spokane River probably exceeds 125 miles, as its course is extremely winding. For a considerable part of its course it flows through vast fields of lava, into which it has cut a deep and picturesque channel. The stream is large and in most places quite deep; the bed in many places is strewn with large granite bowlders or large irregular masses of lava, which render seining next to impossible.

About 6 miles below Cœur d'Alene Lake are Post Falls, which probably do not interfere with the free movement of fish.

In the city of Spokane, where the river breaks through a lava flow, there are several very beautiful falls and rapids, which have been modified in various ways in utilizing the water power for milling purposes. These obstructions, natural and artificial, are impassable to fish. Salmon find no obstructions in the Lower Spokane and ascend as far as these falls. Formerly salmon were said to be abundant as far up as the falls,* but now they are seldom seen farther up than the mouth of the Little Spokane. This stream was examined in and near the city of Spokane by Mr. B. A. Bean in October, 1892, and by Profs. Evermann and Jenkins August 19 and 20, 1893.

The water is clear, cold, and pure. The only contamination is that from the city of Spokane, and that does not seem to be at all serious as yet. An abundance of fish food, such as insects and their larvæ, small mollusks, and crawfish, was noticed in this river.

Cœur d'Alene Lake.—This is one of the largest and most picturesque lakes in Idaho. It is very irregular in shape, occupying, as it does, a narrow mountain valley together with its lateral ramifications. Its greatest length from north to south is probably not less than 22 miles, while its average width is less than 3 miles. The Cœur d'Alene, St. Joseph, and other mountain streams are tributary to this lake, the outlet of which is Spokane River. Trout are abundant and of excellent quality in the lake, but salmon are not known to occur in it. The numerous falls in the Spokane River in the city of Spokane undoubtedly prevent the ascent of salmon to Cœur d'Alene Lake.† This lake was fished August 21 near the outlet, 1½ miles west of Cœur d'Alene. Temperature of water at 4 p.m., 75°; air, 86°.

Hangman Creek.—This is an unimportant stream, tributary to the Spokane. It was examined in the vicinity of Tekoa, Wash., where it was found to be a small, rather filthy stream, not suitable for trout or other food-fishes, but well supplied with minnows and suckers of several species.

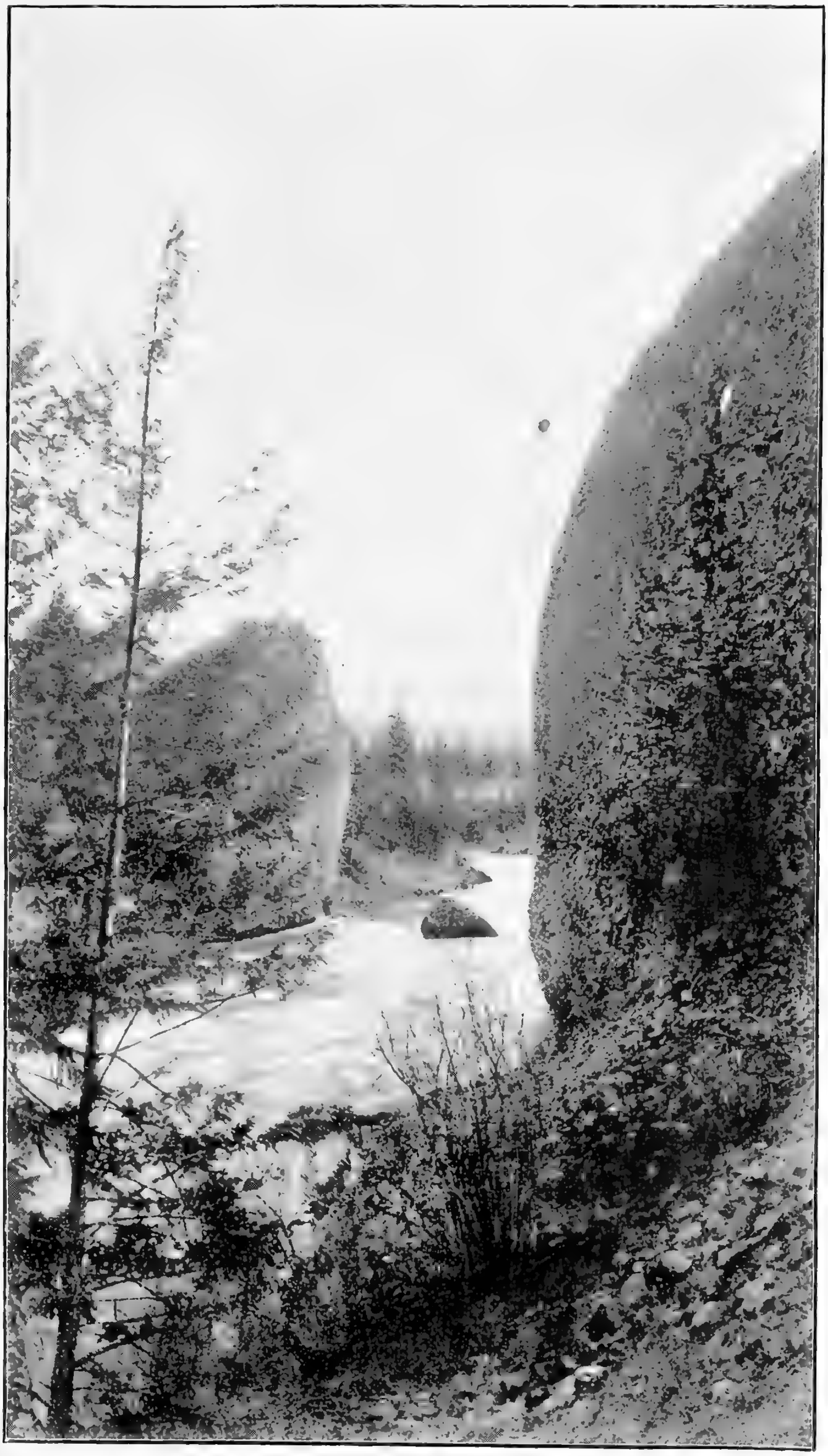
* Regarding the salmon fishing at these falls in 1841, Capt. Wilkes has the following:

"The number of Indians actually resident about the falls is 150; but during the height of the fishing season there are often nearly 1,000, consisting of all the Spokane tribe, who are generally included under the name of the Flatheads. They subsist for the most part on roots, fish, berries, and game. At the opening of the spring, in March and April, or as soon as the snow disappears, they begin to search for a root resembling the cammass, which they call pox-pox. This lasts them till the beginning of May, when it gives place to a bitter root, termed spatylon. This is a slender and white root, not unlike vermicelli in appearance, and when boiled it dissolves into a white jelly, like arrow-root. It has a bitter but not disagreeable flavor, and is remarkable for growing in gravelly soils where nothing else will thrive. In June the itzwa, or cammass, comes in season, and is found in greater quantities than the others all over the country, particularly in the meadow grounds. This root was thought by many of us to have the taste of boiled chestnuts. Before this fails the salmon make their appearance, and during the summer months the Indians enjoy a very plentiful supply of food. While the men are employed fishing, the women are busy digging the cammass, which may be termed the principal occupation of the two sexes. They devote a portion of their time to the collection of berries, a work which is principally the duty of the younger part of the tribes.

"In September and October the salmon still claim their attention, although they are, after having deposited their roes, quite exhausted and about to perish, yet these are dried for their winter consumption, and unless they had recourse to these much want would ensue, which is always the case if the salmon should be scarce."

†The Indian legend given in Wilkes' Narrative, vol. IV, p. 449, is interesting, in that it shows that the falls at Spokane have always been regarded by the Indians as a barrier to the ascent of salmon to Cœur d'Alene Lake:

"They have, in common with the other tribes, many traditions connected with the rivers and remarkable features of their country. In these the prairie wolf bears always a conspicuous part. This wolf was not an object of worship, but was supposed to be endowed with supernatural powers, and to exert them in many ways. On one occasion it is related that the wolf was desirous of having a wife, and visited the tribes on the Spokane for that purpose, demanding a young woman in marriage. This request being granted, he promised that the salmon should be abundant, and for this purpose he raised the rapids, that they might be caught with facility. After he had been gratified in this first instance he made the same request of the others, among them of the Sketsui (Cœur d'Alene) tribe, who were the only ones to refuse. He thereupon formed the great falls of the Spokane, which have ever since prevented the fish from ascending to their territory."



CAÑON OF SPOKANE RIVER, THREE MILES BELOW SPOKANE, WASHINGTON

Little Spokane River.—This was visited by Mr. Barton A. Bean in 1892, and by us August 18, 1893. The Little Spokane rises among the low hills in a system of small streams and lakes in Stevens County, Wash., only 4 or 5 miles from the Pend d'Oreille River. Fed, as it is, by numerous springs, its water is very clear and cold. It flows through a narrow, fertile valley, the low meadows bordering it having a black loamy soil. The immediate banks are for the most part covered with a network of brushes. High hills rise on either side of the valley and they are sparsely covered with pines. Such trees as cottonwood, maples, and alders are common along the banks.

At Dart's mill, where the Little Spokane was examined by us, it averages about 40 feet wide, 20 inches deep (on the ripples), and had a current of $2\frac{1}{2}$ feet per second. The temperature at 2 p. m., August 18, was 63°. The bottom there was of coarse gravel in most places. Just above the dam the water was, of course, deeper and the bottom is of sand and soft mud. Here we found such water vegetation as *Ranunculus aquatilis trichophyllus* and *Myriophyllum* in abundance. A single species of Unionidæ, *Margaritana margaritifera* was not uncommon at this place. Fishes were also rather abundant, some 8 or 10 species being obtained. The Little Spokane is an excellent salmon and trout stream, as is fully evidenced by the great abundance of salmonoid fishes which we found. The cut-throat trout was abundant, as were also young whitefish. Large whitefish (*Coregonus williamsoni*) were seen at the dam at the mill, where Indians were spearing them with fair success. Salmon are said to enter the Little Spokane in considerable numbers even yet, but much less abundantly than formerly. The dam at Dart's mill interferes with their farther ascent and a fishway should be put in. Salmon were quite abundant in this stream in 1882, as reported by Mr. Lane C. Gilliam, of Spokane, to Mr. Livingston Stone.* Mr. Gilliam says:

"I have just completed my second trip to the Little Spokane, and as yet no salmon to speak of are running. The Indians, who are encamped here in great numbers, anticipating a large run, are uneasy and fear the fish are not coming. Yesterday morning they caught eight, which was the largest number taken at any one time as yet. A white man living in the neighborhood told me that last year he made a rough estimate of the salmon taken by the Indians. He thinks they had between 40,000 and 50,000 drying at one time, about October 1. I will make another investigation about October 1."

In the same letter reporting this information to Prof. Baird, Mr. Stone says:

"The result of my researches on the Snake River are that no salmon ascend as high as the crossing of the Utah and Northern Railroad, and that there are no salmon as high as the foot of the American Falls on the Oregon Short Line. The salmon probably can not get over Shoshone Falls. In the spawning season there are a great many salmon at the foot of these falls, 27 miles from the Oregon Short Line Railroad."

It should be added that the character of this stream is being materially changed by the advent of civilization, a fact which is, or has been, true of most streams of this country. The cutting away of the timber and brush on the immediate banks and the cultivation of the land within the drainage area of the stream have greatly increased the surface erosion and, in consequence, the impurities of the stream.

LOWER COLUMBIA RIVER.

Very little work was done by us on the Lower Columbia. Some fishing was done August 22 at Pasco, near the railroad bridge 1 mile east of town, where we made twelve hauls on sand and gravel bars on both sides of the river in water from 1 to 5 feet deep. Took very few fish. Water very clear and cold. Rocks nearly free from algæ. Mr. John E. Gantenheim, an educated and intelligent fisherman of Pasco, says that he fishes every year at the mouth of the Snake and Yakima rivers. The salmon bite readily at a spoon and are in good condition for eating. They are caught by trolling only, and bite greedily, even when full of eggs. Their stomachs are always empty. They spawn on the ripples near the mouths of the Snake and the Yakima rivers. Mr. Gantenheim caught his first salmon for this season on August 20. It was the first he knew of as being caught this year. It was a silverside (*O. kisutch*?), and he took it from the Columbia River near the mouth of the Yakima. We saw three salmon while at the river. Mr. Gantenheim says that the salmon begin their run about the 20th of August, are at their best during September, and last until the high water in October. The last ones are spent and not good eating. He calls the ones he catches silversides and chinooks. Does not know of other forms. Though many fish are caught, none are shipped to the canneries because of railroad charges. It is probable that some of the salmon which are caught by trolling are steelheads.

* Bull. U. S. Fish Com. for 1883.

Walla Walla River.—This is a river of some importance flowing into the Columbia at the town of Wallula, about 30 miles west of Walla Walla. It was examined August 23, at Wallula, below the railroad bridge. It is here a good-sized stream, 3 to 8 feet deep in the channel, and has a velocity of about one-half foot per second. Temperature at noon, 70°; air, 80°. The bed of the stream was of soft mud, with an abundance of *Chara* and other vegetation in places, and the water was rather muddy. At this place Messrs. Thoburn and Rutter obtained the only specimens of *Columbia transmontana* that were secured by any of us.

Mill Creek.—This is a small stream, tributary to the Walla Walla River near Walla Walla. It was examined August 14 south of Walla Walla one half mile. Width, 12 feet; depth, 10 inches; current, 1½ feet. Temperature at 8:30 a. m., 56°; air, 73°. The bottom here is of coarse gravel. We could not learn that salmon are ever taken in this stream.

Umatilla River.—The Umatilla River was examined August 23 near its mouth, and on August 12 near Pendleton, Oreg. At Pendleton it had an average width of 25 feet, depth of 14 inches, and a velocity of 1 foot. Temperature at 11 a. m., 70°. The bottom was of coarse gravel covered with algæ, and the water was clear. Mr. Smith, of the Commercial Stables at Pendleton, says that no salmon come as far up the river as Pendleton. He has never known any salmon to occur there. They probably occur in the lower part of the stream, but we could get no reliable information upon the matter.

Des Chutes River.—This is a southern tributary of the Columbia, into which it flows at a distance of 10 or 15 miles above The Dalles. It was visited August 24. The falls of Des Chutes River, located near its mouth, are about 30 feet high in low water; in high water a series of rapids. In the Des Chutes the difference between high and low water marks varies from 40 to 90 feet, according to the width of the river. The highest water is about June 20, the lowest during the coldest part of the winter. Salmon usually find the falls no obstruction. Numerous salmon are said to run up the John Day River. They are caught in large numbers by the Indians, but we find no authentic information concerning their spawning.

Yakima River.—The Yakima is a good-sized stream, rising in numerous lakes near Snoqualmie Pass, southeast of Seattle about 50 miles, and flowing southeast about 150 miles to Pasco, where it joins the Columbia. At Ellensburg and North Yakima, where this river was visited by Dr. Jenkins, it runs through a broad, fertile valley, and its waters are extensively used for irrigation purposes. At Ellensburg the stream is about 160 feet wide and 10 feet deep, and flows about 1 foot per second. The water is clear and cold; its temperature at 9 a. m., August 24, was 60°. At North Yakima the stream is very clear and flows with a rapid current through an open valley, over gravel and sand, and had a temperature of 64°. The Yakima has many important tributaries, in all of which trout are said to abound.

Wilson Creek near Ellensburg had an average width of about 18 feet, depth of 18 inches, and a current of 2 feet per second.

Manistash Creek empties in on the right bank of the Yakima near Ellensburg. For a few miles above its mouth nearly all the water is taken out for irrigation purposes. Six miles from Ellensburg it comes through a cañon into the valley. At this point it is a fine stream, abounding in trout. It is here 25 feet wide, with a velocity of about 3 feet per second. The water is clear and excellent. The temperature at 11 a. m. was 55°. Below this point, about 2 miles from its mouth, where most of the water is taken out for irrigation, the stream was about 6 feet wide, with an average depth of 6 inches and a velocity of one-half foot per second. Temperature, 58° at 9:45 a. m.

The Yakima was visited also at Prossen, at which point there is a low fall of some 3 or 4 feet, with a long gentle ripple above it. The fall would form no obstacle to the ascent of salmon unless at time of very low water. The temperature was 70° at 10 a. m. At North Yakima the Yakima receives one of its principal affluents from the west. This is the Natchess River, which takes its rise among the snowfields of Mount Ranier and Cowlitz Pass. This is a clear, cold stream, admirably suited to trout. In its lower course such common species as the chisel-mouth (*Acrocheilus alutaceus*), *Agosia nubila*, and *Pantosteus jordani* were found. Those acquainted with the facts state that formerly, up to about 1885, salmon of three or four kinds, including the quinnat, ran up the Yakima River to this valley and spawned in the river in great numbers. At present very few make their appearance.

Cowlitz River.—The Cowlitz River, made famous in Dr. Jordan's delightfully interesting "Story of a Salmon," has its sources in the snowfields on the west slopes of Mount Ranier, and flows through the densely wooded country west of the Cascades for more than 100 miles before it joins the Columbia. This region is very moist and is little suited to agriculture, and the stream will never be needed for irrigation. The Cowlitz was visited by us at Castle Rock. It is there a very deep, sluggish stream,

extensively used for rafting lumber. It had a temperature of about 60°, August 25. Salmon ascend the stream in large numbers to and above Castle Rock. They make their appearance in the fall about the first of September, and are caught by the ton at Castle Rock and at numerous points below. We were informed that two kinds of salmon are taken, quinnat and the silver salmon. The quinnat makes its appearance first, and is, according to reports, obtained in great numbers. We do not know how safely one may rely upon the reports of the fishermen, however.

Toutle River.—Toutle River is a fine, clear stream entering the Cowlitz from the east, about 4 miles above Castle Rock. It was visited by us 2 miles above its mouth. At that point it was about 100 feet wide, averaging perhaps 1 to 1½ feet deep, and was flowing rapidly over rounded bowlders and stones of small size. Its current was perhaps 1½ or 2 feet per second. At 11 a. m. the temperature was 59½°. The stream flows through a very sparsely inhabited country. A few miners and a larger number of lumbermen live on its upper course. It flows everywhere through a dense fir forest, in which are some deciduous trees. All agree that the salmon ascend this stream yearly in large numbers.

In addition to the investigations which were made in the Columbia River basin, some little work was done on streams tributary to Puget Sound, or which flow directly into the Pacific. Drs. Gilbert and Jenkins examined Newaukum and Skookumchuck rivers, and in June, 1892, Prof. Evermann spent parts of two days examining Lake Washington at Seattle, and the Snoqualmie River in the vicinity of Snoqualmie Falls.

NEWAUKUM RIVER.

This stream is a small tributary of Chehalis River, into which it flows near the town of Chehalis. It was visited near its mouth August 27.

SKOOKUMCHUCK RIVER.

This river rises on the divide near the headwaters of the Newaukum, and, flowing to the northwest, empties into an arm of Puget Sound near old Fort Steilacoom.

The Newaukum and the Skookumchuck are both interesting as having furnished us many specimens of young dog salmon. They were found in both of these streams in abundance and were evidently the young of the preceding year.

LAKE WASHINGTON.

This lake is a magnificent body of fresh water, extending for more than 20 miles north and south, just east of Seattle. Some collecting was done here on June 25, 1892. Nothing was found, however, except two or three species of *Cyprinidæ* and a number of blobs.

SNOQUALMIE RIVER.

This river rises near Yakima and Snoqualmie passes and, flowing westward, joins the Snohomish, which in turn flows into the Sound. The Snoqualmie was visited June 26 and 27, 1892, and a small collection of fishes obtained. At the falls this river was 150 to 200 feet wide and about 6 feet deep, entirely too deep for seining, only occasional shallow places being found where the seine could be drawn. At Snoqualmie Falls the river descends 268 feet in a single plunge. Trout, however, are abundant both above and below the falls. The only other species obtained were a few minnows and suckers. We were unable to secure any reliable information as to the occurrence of salmon in Snoqualmie River or in Lake Washington.

NOTES ON THE FISHES OF THE COLUMBIA RIVER BASIN, WITH DESCRIPTIONS OF FOUR NEW SPECIES.

In the following notes on the fishes of the Columbia River basin we have included not only those collected by us, but also the small collections made by Messrs. Bean and Woolman in 1892, and the few species obtained in Newaukum and Skookumchuck rivers by Drs. Gilbert and Jenkins, and in Lake Washington and Snoqualmie River in 1892.

The exact status of several of the species of *Salmonidæ*, as well as some of the minnows and suckers and all the *Cottidæ* of this region, is a matter which will require much additional investigation to determine. Most of the forms which have been regarded as good species are but poorly differentiated. The range of variation seems to be very great, and characters which are of undoubted specific value when applied to Atlantic-drainage species, do not possess any such value for classification of Pacific coast fishes. Each so-called species seems to be in a very unstable state of equilibrium, and not to have yet assumed or been able to retain with any degree of permanence any set of specific characters. This is particularly true of the species of *Agosia, Catostomus, Salmo*, and, possibly, *Oncorhynchus*.

In sequence of species in this paper we follow Jordan's Catalogue of Fishes of North America, 1885.

1. Entosphenus tridentatus (Gairdner). *Three-toothed Lamprey.*

Petromyzon tridentatus Gairdner MS., Richardson, Fauna Boreali-Americana, 293, 1836. Type locality: Falls of Walamet (Willamette) River.

Petromyzon lividus Girard, P. R. R. Survey, 379, 1858. Type locality: Wahlahmath (Willamette) River, Oregon.

Petromyzon astori Girard, loc. cit., 380. Type locality: Astoria, Oregon.

This lamprey was first seen by us at Lower Salmon Falls, on Snake River, on August 8. Over 40 specimens were here found dead on a sand bar below the falls. They had probably died the night before, and had been deposited on the spit, where buzzards were busily feasting on them when we arrived. We were informed that the lampreys in their upward migration reach this point in the river sometime during July, after the water has begun to go down. They are said to make good sturgeon bait, and can be best caught in the evening or in the early morning, when they are found clinging to the rocks at the falls. On August 11, a large number of decayed specimens was found on the banks of the Umatilla River at its mouth. They were high up on the banks, and had apparently died and drifted ashore several weeks before, at a time when the river was higher. They ascend the Umatilla, and are caught by the Indians for food. One dead specimen was seen at Pendleton. A number of larvæ, 1½ to 2 inches long, were taken from débris in the bottom of a pool in the Natchess River at North Yakima.

The lampreys are well known to the owners of salmon-wheels on the Lower Snake and the Columbia, and are universally called eels. At Lewiston, we learned that the lampreys begin their run very early, being already in the stream when the salmon-wheel is first put in place in the spring. They are occasionally caught by these wheels in such numbers as to fill the boat, and are said to be valuable for the oil they contain. This lamprey was seen also by Dr. Eigenmann, at La Grande and Caldwell, in 1892.

2. Acipenser transmontanus Richardson. *Columbia River Sturgeon.*

Acipenser transmontanus Richardson, Fauna Boreali-Americana, III, 278, 1836. Type locality: Columbia River at Fort Vancouver.

The sturgeon ascends the Snake River to above the Upper Salmon Falls, between which and Auger Falls it is frequently taken. We were unable to learn that they passed the Auger Falls, which apparently serve as a barrier to both sturgeon and salmon. We are informed by numerous fishermen that the sturgeon are in the river throughout the year, and can be taken at any season. They are found at Glen's Ferry throughout the year, and we were told of individuals taken there weighing as much as 600 to 800 pounds. No definite information as to their spawning season could be secured.

3. **Pantosteus jordani** Evermann.

Pantosteus jordani Evermann, Bull. U. S. Fish. Comm. for 1892, January 27, 1893, 51. Type locality: Red Rock River, Red Rock, Montana.

Pantosteus columbianus Eigenmann & Eigenmann, American Naturalist, February 4, 1893, 151. Type locality: Boise River, Caldwell, Idaho.

Recent explorations of the Fish Commission have shown this sucker to be an abundant species in the region about the Black Hills in South Dakota and Wyoming. Dr. Eigenmann was the first to obtain it in the Columbia Basin, he having found it at Caldwell, Idaho, in 1892. During our investigations we found this to be an abundant and widely distributed species in the Columbia Basin. Specimens were obtained by us at the following places: Snake River at Idaho Falls, 1; Ross Fork near Pocatello, 49; Boise River at Caldwell, 4; Payette River at Payette, 13; Umatilla River at Pendleton, 3; Columbia River at Umatilla, 1; Natchess River near North Yakima, 9. A comparison of these specimens with a large series from various places in the Missouri River Basin shows them to be specifically identical. Young examples from Payette, Caldwell, and elsewhere, agree perfectly with Dr. Eigenmann's description of *P. columbianus*. The dorsal rays vary from 10 to 13; the scales from 82 to 107.

4. **Catostomus catostomus** (Forster).

Cyprinus catostomus Forster, Philos. Trans., 1773, 155. Type locality: Streams about Hudson Bay.

Specimens from Little Wood River, Shoshone, Idaho, 25; Ross Fork near Pocatello, Idaho, 10; Payette River, Payette, Idaho, 2; Cœur d'Alene Lake, Cœur d'Alene, Idaho, 7; Umatilla River, Pendleton, Oreg., 4; Columbia River, Umatilla, Oreg., 1; Pataha River, Starbuck, Wash., 3; Mill Creek, Walla Walla, 81; Creek at Sand Point, Idaho, 38.

D. 11 or 12; scales, 90 to 104.

This species differs from *latipinnis*, *griseus*, and *catostomus* (Evermann; Eigenmann) in its thin and rather narrow lower lip, which is incised for but little over half its depth. Two well-separated series of large papillæ cross the lip between base of incision and sheath.

5. **Catostomus pocatello** sp. nov. *Moo-gad-ee* of the Fort Hall Indians. (Pl. 21.)

Type locality: Ross Fork of Snake River near Pocatello, Idaho, where 18 specimens were collected August 4, 1893. Type, No. 45385, U. S. Nat. Mus. Co-types, No. 45386, U. S. Nat. Mus., and Nos. 1135 to 1141, Museum Leland Stanford Junior University.

Related to *Catostomus catostomus* (Forster).

Description: Head, 4; depth, 5; eye, $4\frac{1}{2}$; snout, $2\frac{1}{3}$; interorbital width, $2\frac{3}{5}$; D. 10; A. 7; scales, 19–95–14, about 50 before the dorsal. Body moderately stout; head heavy; snout not very pointed; eye rather large—larger than in any related species, its diameter $2\frac{1}{2}$ in snout or $2\frac{1}{6}$ in interorbital width; eye placed high; middle of pupil a little nearer posterior edge of opercle than to tip of snout. Mouth narrow; upper lip rather thick, but not pendent, with three definite rows of papillæ; lower lip incised nearly to base, a single series of small papillæ between sheath and base of incision; lobes of lower lip short and rounded; cartilaginous sheath of lips rather strongly developed. Scales small, crowded, and very much reduced in size on anterior part of body; lateral line imperfect. Origin of dorsal fin midway between tip of snout and base of caudal rays; greatest height of dorsal fin $1\frac{1}{2}$ in head, its free edge very slightly concave. Height of anal a little greater than that of dorsal, $1\frac{2}{5}$ in head; pointed, reaching base of caudal fin. Pectoral about equal to anal; ventral $1\frac{3}{4}$ in head. Peritoneum silvery, with dark punctulations. Air-bladder large.

Color in alcohol, dark olivaceous above, and on sides to below lateral line somewhat mottled with darker; under parts pale. Length, 150 millimeters.

An examination of the series of eighteen specimens shows some variation. Head, $3\frac{5}{6}$ to 4; depth, 5 to $5\frac{1}{6}$; eye, $4\frac{1}{2}$ to 5–4 in young; snout, $2\frac{1}{3}$ to $2\frac{2}{5}$–$2\frac{1}{2}$ in young. The number of dorsal rays is usually 10, but in one example there are but 9. There is considerable variation in number of scales in the lateral line, the number in eleven examples counted being 90, 93, 93, 95, 96, 96, 100, 101, 105, 106, 107, and 108, respectively; the lateral line is frequently irregular and imperfectly developed.

From *Catostomus catostomus*, which this species resembles, it differs in its larger eye, fuller lower lip, and somewhat larger head. These characters may all prove unreliable, however. From *C. griseus* and *C. latipinnis* of the same size it differs in its narrower upper lip and larger eye, as well as in other minor characters.

This species was found only in Ross Fork just above the Fort Hall Indian Agency. It does not seem to be very common, as a day's collecting in this stream resulted in taking only 18 specimens of the species. It apparently does not attain a length of more than 6 to 8 inches. The Indian name *Moo-gad-ee* means *sucker*, or *that which sucks*.

6. **Catostomus macrocheilus** Girard.

Catostomus macrocheilus Girard, Proc. Acad. Nat. Sci. Phila. 1856, 175. Type locality: Astoria, Oregon.

Specimens obtained from Payette River at Payette, 5; Boise River at Caldwell, 17; Clearwater Creek at Lewiston, 2; Hangman Creek at Tekoa, 6; Hangman Creek at Spokane, 1; Pataha River at Starbuck, 7; Walla Walla River at Wallula, 5; Colville River near Colville, 10; Umatilla River at Pendleton, 2; Snake River, at Payette, 2; Columbia River at Umatilla, 1; Skookumchuck River near Centralia, 7; Post Creek, St. Ignatius Mission, Mont., 1; Pend d'Oreille River, Newport, Idaho, 19.

This is the common sucker of the Columbia and Lower Snake rivers, and large numbers were frequently seen feeding in the shallow waters along shore. In 25 specimens the dorsal rays were as follows. Thirteen rays in 1 specimen, 14 in 15, 15 in 8, 16 in 1. Scales 67 to 70. The four specimens reported by Eigenmann from Idaho Falls are more likely referable to *C. ardens; C. macrocheilus* probably does not occur in the Upper Snake.

7. **Catostomus ardens** Jordan & Gilbert.

Catostomus ardens Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 464. Type locality: Utah Lake, Provo, Utah.

Six specimens from Mink Creek, near Pocatello, are identified with this species. No adults of *C. ardens* were obtained, and the status of *ardens* and *macrocheilus* in the Columbia can not be determined until a larger series is available for comparison. In all suckers of this type thus far taken from Snake River above the falls, including those from President Camp and from Heart Lake, the dorsal fin is small, containing but 11, 12, or 13 rays; and the caudal peduncle is thicker than in specimens of *macrocheilus* of equal size. Measurements of our specimens are given in the following table:

Coll. No.	Head.	Depth.	Eye.	Snout.	Dorsal.	Anal.	Scales.	Length in inches.
2	$4\frac{2}{5}$	$4\frac{2}{5}$	6	$2\frac{2}{3}$	13	7	10-67-8	10
3	$4\frac{3}{5}$	$4\frac{4}{5}$	6	$2\frac{1}{4}$	13	7	10-67-8	$9\frac{1}{2}$
20	....	....	....	....	12	....	71	....
21	....	....	....	....	13	....	70	....
22	....	....	....	....	12	....	66	....
23	....	....	....	....	12	....	66	....

8. **Acrocheilus alutaceus** Agassiz & Pickering. "*Chisel-mouth.*"

Acrocheilus alutaceus Agassiz & Pickering, Amer. Jour. Sci. and Arts, 1855, 99. Type localities: Falls of the Willamette and in Walla Walla River.

Specimens obtained from Payette River at Payette, 53; Pataha Creek at Starbuck, 1; Umatilla River at Pendleton, 15; Natchess River at North Yakima, 2; Walla Walla River at Wallula, Wash., 1; Columbia River at Umatilla, 26; Potlatch Creek, 2 miles above mouth, 19; Snake River at Payette, 17; Boise River at Caldwell, 5.

So far as known this species is confined to the Columbia River basin, where it is one of the most abundant and most widely distributed of the minnows. It has not yet been found in Snake River above the falls, nor is it known from the Pend d'Oreille basin.

9. **Rhinichthys cataractæ dulcis** (Girard). *Western Dace; Mot-to-nut-se* of the Fort Hall Indians.

Argyreus dulcis Girard, Proc. Acad. Nat. Sci. Phila. 1856, 185. Type locality: Sweetwater River, Nebraska.

This widely distributed species is represented in the collection by the following: Mouth of Colville River, 1; Snake River at Idaho Falls, 2; Ross Fork near Pocatello, 64; Little Wood River near Shoshone, 9; Cœur d'Alene Lake, 14; Columbia River at Pasco, 3; Natchess River at North Yakima, 11; Post Creek, St. Ignatius Mission, Mont., 6; Clarke Fork at Thompson Falls, Montana, 2.

This species has hitherto been reported from the Columbia River basin from but one place—Snake River, at President Camp;* it seems, however, to be a pretty common fish throughout that basin. It was obtained by Woolman and Bean in Post Creek and at Thompson Falls, the only places in the Pend d'Oreille system where it has yet been found. The Indian name refers to the motion of the nose in eating.

10. Agosia nubila (Girard).

Argyreus nubilus Girard, Proc. Acad. Nat. Sci. Phila. 1856, 186. Type locality: Fort Steilacoom, Washington.

Since the original description of this species no specimens have until now been taken from near the type locality. The name has been recently used by Jordan and others for the *Agosia* inhabiting the Upper Snake River and the Great Basin in Utah, being thus considered synonymous with the numerous nominal species (*carringtonii, vulnerata, rhinichthyoides, henshavii,* and *novemradiata*) described by Cope from streams tributary to Great Salt Lake. As this identification has been based upon a comparison with the imperfectly preserved types of *nubila*, the present collection is of great interest, containing, as it does, material from 15 localities, distributed between the Newaukum River in western Washington and the tributaries of the Upper Snake River in southeastern Idaho. A study of this material has shown the desirability of recognizing as a distinct subspecies *Agosia nubila carringtonii*, the form found in the Great Basin and the Upper Snake River.

Examination of the annexed tabular statement will show the astonishing amount of variation which this species exhibits. Thus, the crosswise series of scales varies from 47 to 70 in number; the barbel is present or absent; the pharyngeal teeth vary from 1, 4–4, 0 to 2, 4–4, 2; and the dorsal fin varies much in position and somewhat in size. These characters occur in various combinations, and with some of these are often correlated peculiarities of physiognomy and general appearance, all of which may serve to put a certain stamp upon the individuals from a single stream, or even from one locality in a stream. Disregarding such local variations, we find that our material, exclusive of the specimens of *A. nubila carringtonii*, falls more or less clearly into three groups, distributed around certain geographical centers. Whether we are here dealing with subspecies seems doubtful, and can be determined only by more extensive and detailed exploration. The first of these forms, typical *nubila*, is represented in our collection by a large number of specimens from the Newaukum and Skookumchuck rivers in western Washington, very near the type locality of the species. These are all very dark in coloration, and have a jet-black lateral band which extends along sides of head and encircles the snout. This band is absent in our second and third groups, found east of the Cascades, or it is at most only faintly indicated. The darker coloration of the coastwise form may be due to its inhabiting a densely forested area, possessing different climatic conditions from those characterizing the dry semidesert of eastern Washington and western Idaho. Both the typical *nubila* and the lighter interior form which centers about Umatilla are characterized by their coarse scales (averaging 54 along the lateral line) and their peculiar markings. The latter are due to the fact that numerous scattered scales along the back and sides are of a dark slate color, contrasting sharply with the lighter ground.

The third group centers in the Spokane region, and is characterized by smaller scales, the less-marked peculiarities of coloration, and the almost uniform absence of the maxillary barbel. The inconstancy of this important generic character within the limits of the species has been heretofore noticed only by Cope, who in notes on *Apocope vulnerata* † calls attention to its occasional absence. In our specimens from other than the Spokane district the barbel is very rarely lacking.

The significance of the groups above outlined can be determined satisfactorily only by the study of a much more extensive series than that on which this paper is based. An open waterway exists between them, and it is useless to attempt to indicate their value while so large a part of the Columbia and adjacent basins remain unexplored.

11. Agosia nubila carringtonii (Cope). *Mo-sha-pog-gee.*

Apocope carringtonii Cope, Hayden's Fifth Annual Report, 1871 (1872), 472. Type locality: Warm Springs, Utah.

* Evermann, Bull. U. S. Fish Comm. for 1891 (1892), 42.

† Cope, Zool. Wheeler's Survey W. 100th Merid., 647, 1876.

We include under this name the *Agosia* of the Great Salt Lake basin (exclusive of the Sevier River) and of the Upper Snake River. Our collection contains specimens from Port Neuf River, Mink Creek, and Ross Fork near Pocatello, and from Little Wood River at Shoshone. It differs from *nubila* in its finer scales (average about 65) and in the absence of the sharply marked blackish scales on the sides. The Fort Hall Indians, to whom we showed specimens of this minnow, called it *Mo-sha-pog-gee*, a word which they say describes its eating habits.

12. Agosia umatilla sp. nov. (Pl. 21.)

Type locality: Columbia River at Umatilla, Oregon, where 15 specimens were collected, August 11, 1893, by Messrs. Gilbert and Rutter. Type, No. 45390, U. S. Nat. Mus. Co-types, No. 45391, U. S. Nat. Mus., and Nos. 1142 to 1147 (Umatilla) and 1148 to 1150 (Payette) Museum Leland Stanford Junior University.

Associate type locality: Payette River at Payette, Idaho, where 3 specimens were secured, August 9, 1893, by Messrs. Gilbert, Thoburn, and Rutter.

Related to *Agosia falcata* and *Agosia nubila carringtonii*.

Description: Head, $3\frac{5}{6}$; depth, $4\frac{3}{4}$; eye, 4; snout, 3. D. I, 9; A. I, 7; scales, 14–68–8, about 30 before the dorsal. Teeth, 1, 4–4, 1 hooked. The body is rather slender, the back somewhat elevated; head pointed, narrow; mouth inferior, nearly horizontal, narrow; caudal peduncle compressed, slender, its least depth 2 in head. Origin of dorsal fin slightly behind insertion of ventrals and about midway between base of middle caudal rays and nostril; dorsal fin falcate, the anterior rays nearly as long as head, their tips reaching well behind posterior rays when deflexed; rudimentary ray not enlarged nor spinelike; anal strongly falcate, the anterior rays much produced, about as long as head and more than twice the length of the posterior rays; pectoral not quite reaching ventrals, $1\frac{1}{5}$ in head; ventrals reaching well beyond front of anal, $1\frac{1}{2}$ in head; caudal deeply forked; no ventral stays. Barbel minute; upper lip without frenum. Color in alcohol, olivaceous above, covered with obscure patches of darker; sides with a distinct plumbeous band following the course of the lateral line and extending forward through the eye and around snout; side with a number of dark blotches, usually imperfectly defined, partly covering the plumbeous band; a large dark blotch on base of caudal peduncle, and one or two smaller ones on base of caudal rays. Length, 65 mm.

The range of variation, as shown by the co-types, is not great. Depth, $4\frac{3}{4}$ to 5; eye, $3\frac{1}{2}$ to 4; scales, 13 or 14, 60 to 70–7 or 8; D. 8 or 9. There are slight but unimportant color differences. (For variation in measurements, see table.)

This species is somewhat intermediate between *Agosia falcata* and *A. nubila carringtonii*. From the former it may be distinguished by its notably smaller scales, absence of ventral stays, and smaller eye; from the latter it differs in its longer, more slender snout and larger, strongly falcate fins. As in *A. falcata*, the top of head and anterior portion of trunk are often covered with minute nuptial tubercles. From *Agosia adobe* it differs in the larger eye, which is contained $1\frac{1}{3}$ to $1\frac{1}{2}$ times in snout, while in *A. adobe* it is contained 2 to $2\frac{1}{2}$ times; the fins are higher and more falcate, and the scales below lateral line are larger. The 3 specimens obtained from Payette River do not differ materially from those found at Umatilla.

13. Agosia falcata Eigenmann & Eigenmann.

Agosia falcata Eigenmann & Eigenmann, American Naturalist for February, 1893, 153. Type locality: Boise River, Caldwell, Idaho.

This interesting species was obtained by us at the following places: Boise River at Caldwell, 97; Payette River at Payette, 27; Snake River at Payette, 1; Mill Creek near Walla Walla, 1; Columbia River at Umatilla, 55; Columbia River at Pasco, 5.

In the following table we give measurements of a number of specimens:

	Boise River at Caldwell.											Payette River at Payette.					
Head	4	4	$3\frac{3}{4}$	$3\frac{5}{6}$	4	4	$3\frac{5}{6}$	$3\frac{3}{4}$	$3\frac{3}{4}$	$3\frac{1}{5}$	$3\frac{1}{5}$	$3\frac{1}{5}$	$3\frac{4}{5}$	4	4	$3\frac{4}{5}$	$3\frac{4}{5}$
Depth	$4\frac{1}{5}$	$4\frac{4}{5}$	5	$5\frac{1}{4}$	5	5	$4\frac{4}{5}$	$4\frac{3}{4}$	5	4	$3\frac{1}{2}$	$4\frac{1}{3}$	5	5	$4\frac{3}{4}$	5	5
Eye	$3\frac{3}{4}$	4	$3\frac{1}{2}$	$3\frac{1}{2}$	$3\frac{1}{3}$	$3\frac{4}{5}$	$3\frac{1}{2}$	$3\frac{3}{4}$	4	$3\frac{1}{2}$	$3\frac{1}{2}$	$3\frac{1}{2}$	$4\frac{1}{5}$	$3\frac{1}{2}$	$3\frac{1}{2}$	$3\frac{3}{4}$	$3\frac{3}{4}$
Snout	$2\frac{5}{6}$	$2\frac{5}{6}$	$2\frac{3}{4}$	3	3	$2\frac{4}{5}$	$2\frac{5}{6}$	3	3	$2\frac{3}{4}$	$2\frac{3}{4}$	3	3	3	3	3	3
Dorsal	9	9	9	9	10	9	9	9	9	9	9	...	...	...	...	...	...
Anal	7	7	7	7	7	7	7	7	7	7	7	...	...	...	...	...	...
Scales	56	56	53	53	55	55	55	54	56	55	59	...	...	...	...	...	...

One of the most characteristic marks of this species is the presence of two or three membranous stays connecting the inner ventral rays with the skin of the body, thus forming pockets under the ventral fins and holding them down quite firmly. Adults show an extraordinary development of the nuptial tubercles, which are present on top of head, and on back and sides of body. On the body a single tubercle is located on the middle of the free edge of each scale, being formed by a thickening of the integument. On the belly, this thickening involves the entire surface of the scales, giving to this region a mosaic-like appearance. Beneath this thickened epidermis the scales are often partially absorbed, especially on the breast. Tubercles are also present on the inner (superior) surfaces of the pectoral fins, where they follow the fin rays in single series, branching to correspond with the forking of the ray.

We find the origin of the dorsal fin in this species constantly behind the front insertion of the ventrals. It varies from midway between base of median caudal rays and nostrils (its usual position) to a point midway between caudal and posterior margin of pupil. The variation includes the position of the dorsal assigned as a distinguishing feature in *Agosia shuswap* Eigenmann, this being the only character assigned as distinguishing *shuswap* from *falcata*.*

Table showing variation in species of Agosia.

Locality.	Head in length.	Depth in length.	Eye in head.	Snout in head.	Barbel: + = present. ○ = absent.	Teeth.	Dorsal fin.	Position of dorsal fin.	Anal fin.	Scales.	Average No. of scales in lat. line.	No. of specimens in collection.	No. of examples examined.
Agosia nubila.													
Colville River, Meyers Falls.	3¾–4	3¾–4	4	3	○	1, 4–4, 1	8	To eye......		52–57	55	10	6
Little Spokane River, Dart's Mill.	4	4 –4½	4½–5	3	○	2, 4–4, 2	8 or 9	To preopercle....		52–63	62	77	9
Hangman Cr., Tekoa ..	3¾–4	4 –4⅓	4⅓	......	+ in 1 ○	1, 4–4, 2 2. 4–4, 2	8 or 9	Beyond preopercle. ...		51–65	57	50	10
Cœur d'Alene Lake ...	......	......	......	......	○ in 34 + in 10	1, 4–4, 2	8 or 9	Middle of pupil. ...		64–70	66	44	9
Clearwater R., Lewiston.	......	......	......	......	......	......	8 or 9	......	......	......	......	9	9
Boise R., Caldwell	4	4¾	3½	3⅙	+	1, 4–4, 1	8	To eye.......	7	56	56	1	1
Potlatch Cr., Lewiston.	3¾–4⅓	3¾–4⅓	4 –4½	2½–3	○	1, 4–4, 0 1, 4–4, 1 2, 4–4, 2	8 or 9	To preopercle.	7	60–66	62	10	10
Pataha R., Starbuck ..	4 –4¼	4 –4½	4½–5	2¾–3	+	......	8 or 9	To pupil......		60–64	62	13	9
Walla Walla R., Wallula.	3¾–4	4	4 –4½	2¾ 3	−	......	......	To preopercle ...		47–55	49	39	15
Mill Cr., Walla Walla.	......	......	......	......	+	......	......	...do		52–61	55	20	20
Umatilla R., Pendleton.	......	......	......	......	+	2, 4–4, 2	......	......	......	48–58	52	......	3
Columbia R., Umatilla.	3¾–4	4½	3½–4	2¾–3	+	......	......	......	......	48–57	53	7	7
Natchess River, North Yakima.	......	......	......	......	+	......	......	......		53–58	56	......	......
Newaukum River, Chehalis.	......	......	......	......	+	......	......	......	......	53–58	55	......	......
Skookumchuck River, Chehalis.	4	4⅓–4½	3¾–4	2⅗–3⅙	+	......	......	......	......	50–57	55	6	6
A. nubila carringtonii.													
Port Neuf River, Pocatello.	4	4⅓	3¾	3¾	○	1, 4–4, 1	8	To eye.......	7	69	69	1	1
Ross Fork, Pocatello..	......	......	......	......	+	......	......	To front of eye.	7	53–72	64	15	13
Mink Creek, Pocatello.	4⅓	4⅓	4	3	+	......	9	To eye.......	7	65	65	1	1
Port Neuf River, Pocatello.	......	......	......	......	+	......	......	To pupil.......		61–67	64	4	4
Idaho Falls	4⅓	4⅓	4	3	+	......	9	To front of eye.	7	62–63	62½	2	2
Little Wood River	3⅘–4¾	4⅖–5	4–4¾	3 –3⅓	+	......	......	To eye.........		63–79	71	48	10
Payette R., Payette ...	3¾	4½	4⅓–5	......	+	......	8 or 9	......	7	60–65	64	6	6
A. falcata.													
Boise River, Caldwell.	3¾–4	4½–5¼	3½–4	2¾–3	+	......	9 or 10	......	7	53–59	56	97	11
Payette R., Payette...	3¾–4	4⅓–5	3½–4⅕	3	+	......	......	......	......	......	......	27	6
Columbia R., Umatilla.	4 –4⅕	4¾–5	3½–4	2¾–3	+	1, 4–4, 1	9 or 10	To nostril	7	52–58	56	55	8
A. umatilla.													
Columbia R., Umatilla.	3½–4	4½–5	4	2½	+	1, 4–4, 1	8 or 9	To front of pupil.	7	63–70	66	10	10
Payette R., Payette ...	3¾	4½–5	4⅓–5	2¾–3	+	1, 4–4, 1	8 or 9	......	7	60–65	63	6	6

*Eigenmann, American Naturalist, February, 1893, 154.

14. Couesius greeni Jordan.

Couesius greeni Jordan, Proc. U. S. Nat. Mus. 1893, 313. Type locality: Stuart Lake near Fort St. James, British Columbia. (Type, No. 44454, U. S. Nat. Mus.)

In the collection made by Messrs. Bean and Woolman, September 20, 1892, in a small creek at Sand Point, Idaho, we find three examples of this species. In length they measure $2\frac{3}{4}$, 3, and $3\frac{1}{4}$ inches, respectively. Head in length of body, $4\frac{1}{7}$, $4\frac{1}{5}$, $4\frac{1}{7}$; depth, $4\frac{3}{4}$, 5, 5; eye, 4, $3\frac{1}{2}$, $3\frac{1}{2}$; snout, $3\frac{1}{2}$, $3\frac{1}{2}$, $3\frac{1}{2}$; interorbital width, $3\frac{1}{2}$, $3\frac{1}{4}$, 3; D. 8; A. 8; scales, 10-55-6, 11-60-5, 11-60-6; 34 before the dorsal. The origin of the dorsal fin is at a point midway between base of caudal fin and the preorbital (not "preopercle," as given in the original description of *C. greeni*, evidently a misprint for "preorbital"). These Sand Point specimens agree well with the type of *C. greeni* with which we have compared them. This species seems to differ from the *Couesius* of the Upper Missouri basin (*Couesius dissimilis*) in the somewhat larger scales and in having the scales less crowded on anterior part of body.

15. Cyprinus carpio Linnæus. *Carp.* The carp has been introduced into a number of ponds and small lakes of the Columbia basin and from these has escaped into the streams. We saw it in Payette River at Payette and heard of it elsewhere.

16. Mylocheilus caurinus (Richardson). "*Chub*"; "*Whitefish.*"

Cyprinus (Leuciscus) caurinus Richardson, Fauna Boreali-Americana, III, 304, 1836. Type locality: Columbia River, at Fort Vancouver.

Specimens obtained from Pend d'Oreille River at Newport, Idaho, 1; Boise River at Caldwell, Idaho, 19; Payette River at Payette, Idaho, 7; Snake River at Payette, Idaho, 8; Columbia River at Umatilla, Oreg., 16; Walla Walla River at Wallula, Oreg., 13; Blue Lakes, Idaho, 8; Umatilla River at Pendleton, Oreg., 1. An abundant and widely distributed fish in the Lower Columbia basin; not known from Snake River above the falls, and probably does not occur there. Observed to be very abundant in the Pend d'Oreille below Newport.

17. Ptychocheilus oregonensis (Richardson). "*Squawfish.*"

Cyprinus (Leuciscus) oregonensis Richardson, Fauna Boreali-Americana, III, 305, 1836. Type locality: Columbia River, at Fort Vancouver.

Specimens obtained from Payette River at Payette, Idaho, 27; Hangman Creek at Tekoa, Wash., 9; Clearwater Creek at Lewiston, Idaho, 2; Potlatch Creek near Lewiston, Idaho, 3; Snake River at Payette, Idaho, 2; Boise River at Caldwell, Idaho, 28; Walla Walla River at Wallula, Wash., 1; Columbia River at Pasco, Wash., 6; Columbia River at Umatilla, Oreg., 4; Umatilla River at Pendleton, Oreg., 6; Natchess River at North Yakima, Wash., 4; Skookumchuck River near Centralia, Wash., 28; Newaukum River near Chehalis, Wash., 8; Mouth of Colville River, Colville, Wash., 6; Spokane River below Spokane, Wash., 10; Lake Pend d'Oreille at Sand Point, Idaho, 1; Pend d'Oreille River at Newport, Idaho, 7; Flathead Lake, Mont., 28. In the Pend d'Oreille River the squawfish is even more abundant than *M. caurinus*. No differences could be discovered between the above-mentioned specimens and others from the Sacramento River basin in California.

18. Leuciscus hydrophlox (Cope). *Po-he-wa.*

Clinostomus hydrophlox Cope, Hayden's Fifth Annual Report, 1871 (1872), 475. Type locality: Blackfoot Creek, Idaho.

Clinostomus montanus Cope, l. c., 475. Type locality: Grass Creek, Idaho.

Clinostomus tænia Cope, Trans. Amer. Philos. Soc. Phila. 1874, 133. Type locality: Utah Lake.

Numerous specimens of this species were collected in the Snake River at Idaho Falls, in Ross Fork of Snake River (on the Fort Hall Indian Reservation), and in Mink Creek and Port Neuf River near Pocatello, Idaho. The Indian name *Po-he-wa* means *striped*. The following tabular statement shows the variation in the number of anal fin rays among the examples collected at these places.

Locality.	Number of specimens collected.	9 anal rays.	10 anal rays.	11 anal rays.	12 anal rays.	Average number of rays in anal.
Idaho Falls	13	....	1	9	3	11
Ross Fork	52	1	17	37	6	$12\frac{1}{2}$
Mink Creek	5	....	1	4	....	11
Port Neuf River	118	....	41	65	12	11

Numerous specimens (83) obtained in 1891 in the Snake River at President Camp and in a small creek at the head of Jackson Lake, Wyoming,* have 11 or 12 anal rays, 12 being the number in most of the examples counted. In 1892, Dr. Eigenmann obtained specimens at Idaho Falls, 2 of which have 12, 14 have 13, and 4 have 14 anal rays each. Putting these with the 13 collected by us, gives an average of $12\frac{1}{3}$ anal rays for that locality. This species was obtained also by Jordan & Gilbert in 1889 in Heart Lake and Witch Creek, in Yellowstone Park.† The specimens examined by them had 13 anal rays. In specimens from Idaho Falls the scales of lateral line range as follows: 52, 53, 53, 53, 55, 55, 57, 57, 58, 61; from Port Neuf River, 51, 51, 51, 52, 53, 53, 55, 57. Head from 4 to $4\frac{1}{3}$ in length, eye $3\frac{2}{3}$ to $3\frac{3}{4}$ in head. The maxillary scarcely reaches front of eye, and is 3 to $3\frac{1}{6}$ times in head.

19. Leuciscus lineatus (Girard).

Tigoma lineata Girard, Proc. Acad. Nat. Sci. Phila. 1856, 206. Type locality: Not definitely known, but probably somewhere in the Utah basin.

Tigoma atraria Girard, l. c., 208. Type locality: "A spring in the Utah district, near the desert."

Tigoma obesa Girard, Proc. Acad. Nat. Sci. Phila. 1856, 206. Type locality: Salt Lake Valley.

Tigoma squamata Gill, Proc. Bost. Soc. Nat. Hist. 1861, 42. Type locality: Salt Lake Basin.

Squalius cruoreus Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 400. Type locality: Utah Lake; young specimens.

Squalius rhomaleus Jordan & Gilbert, l. c., 461. Type locality: Utah Lake; large specimens.

Siboma atraria longiceps Cope. Zool. Wheeler Surv., v, 667, 1876. Type locality: Snake Creek, Nev.

This species was obtained at the following places: Idaho Falls; Port Neuf River at Pocatello; Payette River at Payette. Others were seen at American Falls, in Snake River. Besides the localities given in the above synonymy, this fish has been reported from the following additional points in the Snake River basin: Heart Lake and Witch Creek, in Yellowstone Park (Jordan & Gilbert, 1889); Snake River at President Camp; Jackson Lake and a small creek at upper end of Jackson Lake, Wyoming, (Evermann & Jenkins, 1891); Snake River at Idaho Falls, Idaho (Eigenmann). In the Columbia basin it seems to be entirely confined to the Snake River, and in that stream its occurrence below the falls is exceptional. It is an excessively abundant fish in the Great Salt Lake basin, particularly in Utah Lake.

In the canal at Idaho Falls we easily caught this and the preceding species by placing dough inside a small dip net and allowing it to rest a short time on the bottom; great numbers of the two species, particularly of *L. hydrophlox*, would soon begin feeding on the dough, when they could be easily secured by lifting the net. In all recent papers this species has been listed under the name *Leuciscus atrarius*, but it seems quite certain that *Tigoma lineata* Girard is the same fish; and this, being the older name, must take the place of *atrarius*.

20. Leuciscus aliciæ Jouy

Tigoma gracilis Girard, Proc. Acad. Nat. Sci. Phila. 1856, 206; not *Cyprinus* (*Leuciscus*) *gracilis* Richardson.

Squalius copei Jordan & Gilbert, Proc. U. S. Nat. Mus. 1880, 461; not *Leuciscus copei* Günther.

Leuciscus aliciæ Jouy, Proc. U. S. Nat. Mus. 1881, 10. Type locality: Utah Lake.

This species was found very abundant in Little Wood River at Shoshone, where 86 specimens were obtained. Slight differences are found on comparison of these specimens with others from the Sevier River, Utah, but these differences are not likely to prove constant and are not more extensive than are frequently found on comparing specimens from adjacent tributaries of the same stream. The eye is a trifle larger, the caudal peduncle rather more slender, the pectoral and ventral fins seem to average a little shorter, and the dorsal may be a little more anterior in position.

This species has been previously known only from Sevier River, Beaver River, and Provo River in Utah. Its occurrence in the valley of the Upper Snake River is one more evidence of the identity of the two faunas. At least 8 of the species of our collection from the Upper Snake River are also found in the Great Salt Lake Basin of Utah. They are *Catostomus ardens*, *Rhinichthys dulcis*, *Agosia nubila carringtonii*, *Leuciscus hydrophlox*, *Leuciscus aliciæ*, *Leuciscus lineatus*, *Coregonus williamsoni*, and *Cottus punctulatus*.

The following is a detailed description of our specimens from Little Wood River: Head, 4 ($3\frac{3}{4}$ to $4\frac{1}{2}$); depth, 4 to $4\frac{1}{2}$; eye, $3\frac{3}{4}$ to 4; snout, $3\frac{3}{4}$ to 4. D. 8; A. 8, in 52 specimens, 9 in 34. Scales, 18–79 to 83–13. Body elongate, moderately compressed; head short and heavy,

* Evermann, Bull. U. S. Fish Comm. for 1891, 44. † Jordan, Bull. U. S. Fish Comm. for 1889, 48.

interorbital width a little greater than snout; snout decurved; mouth wide, oblique, lower jaw very slightly projecting; maxillary reaching to within front of orbit; caudal peduncle long, the distance between anal fin and base of caudal about $1\frac{1}{6}$ in head, least depth of caudal peduncle $2\frac{2}{3}$ in head. Fins small; height of dorsal $1\frac{1}{2}$ in head, its free edge slightly convex; origin of dorsal somewhat behind ventrals, a little nearer base of caudal than tip of snout; anal about size of dorsal; length of pectoral equal to height of dorsal, their tips rarely reaching base of ventrals; ventrals short, equal to snout and eye. Lateral line somewhat interrupted, little decurved; scales crowded anteriorly.

21. Leuciscus balteatus (Richardson).

Cyprinus (Abramis) balteatus Richardson, Fauna Boreali-Americana, III, 301, 1836. Type locality: Columbia River, presumably at Fort Vancouver, Washington.

Richardsonius lateralis Girard, Proc. Acad. Nat. Sci. Phila. 1856, 202. Type locality: Fort Steilacoom, Puget Sound.

This is one of the most abundant species of the Columbia and Lower Snake River, but appears not to occur in the Upper Snake, where it is replaced by *L. hydrophlox*. The accompanying table shows the stations at which this species was taken, together with the number of individuals from each locality, and the number of rays in the anal fin. It will be seen that the latter vary, in our specimens, from 11 to 22 in number, the averages in the counts from the different localities ranging from 13 to 18.

In a recent paper,* Dr. Eigenmann announces the discovery that in this species the number of anal rays decreases with increasing altitude or that "the higher the altitude the fewer the number of rays and the narrower the limits of variation." To successfully establish such a generalization a very large amount of evidence would be necessary. As a contribution to this question we append the following table, which can not, we think, be interpreted as showing the truth of the theory. In this table we give, (1) the localities from which specimens were examined; (2) the range in variation in anal rays among the individuals; (3) the total number examined from each locality; (4) the average number of anal rays for each locality, and (5) the approximate altitude of each place. Fractions of $\frac{1}{2}$ or more are included in the next higher number:

Locality.	Number of anal rays.														Total No. examined.	Average No. anal rays.	Approximate elevation in feet.
	11	12	13	14	15	16	17	18	19	20	21	22	23	24			
Little Spokane River, Dart's Mill	1	14	30	19	6										70	13	1,850
Colville River, Meyers Falls			7	5	6	2			1						21	14	1,200
Spokane River, Spokane		1	1	5	1	3									11	14	1,910
Revelstoke, B. C. *a*					1										1	15	1,475
Browns Gulch, Silver Bow			2	10	1	1									14	14	5,344
Umatilla River, Pendleton		1	5	10	9	1									26	14	1,070
Lake Washington, Seattle		1	16	11	13	4	1	1							47	14	1
Flathead Lake			1	1	6	3									11	15	3,100
Griffin Lake, B. C. *a*				3	7	3	1								14	15	1,990
Small Creek at Sand Point, Idaho			2	19	36	3	6	1							67	15	2,100
Pend d'Oreille River, Newport				5	1	2									8	15	2,000
Hangman Creek, Spokane			2	2	5	2									11	15	1,910
Natchess River, North Yakima		1		3	1	3									8	15	1,078
Newaukum River, Chehalis					2	1									3	15	204
Post Creek, Flathead Lake					4	1	1								6	15½	3,100
Golden, B. C. *a*				1	7	5	4	1							18	16	2,550
Boise River, Caldwell		1	2	5	10	21	12	8	4	2					65	16	2,372
Skookumchuck River, Chehalis			2		1	7	2	1							13	16	204
Payette River, Payette			3	25	29	27	28	25	12	3	2				154	16	2,150
La Grande, Oregon *a*				2	6	11	4								23	16	2,786
Potlatch Creek, Lewiston						1	1	2							4	17	1,200
Sicamous, B. C. *a*				1	3	13	28	8	5						58	17	1,300
Walla Walla River, Wallula						2	2		2						6	17	326
Caldwell, Idaho *a*				1	2	6	7	8	7	2	1				34	18	2,372
Clearwater River, Lewiston						3	5	4	4						16	18	750
Columbia River, Pasco							1	1	1						3	18	375
Umatilla River, Umatilla					1	1	2	2	5	1					12	18	300
Snake River, Payette						1	1	4	3	1					10	18	2,150
Umatilla River, Umatilla *a*							1	5	1	2	1				10	19	300
Mission, B. C. *a*						2	7	13	25	18	8	2	2	2	79	19	1
Kamloops, B. C. *a*										1	1				2	20½	1,158

a These are the localities from which specimens were examined by Dr. Eigenmann. The data are those given by him.

* Results of Explorations in Western Canada and the Northwestern United States. Bull. U. S. F. C. 1894, 131.

In the preceding table we have arranged the data beginning with the lowest average number of anal rays (13), and proceeded from that to the highest (20½). In the table which follows we have arranged the localities in order of elevation, beginning with the lowest.

Table showing the relation of altitude to number of anal fin rays in Leuciscus balteatus.

Localities.	Approximate altitude.	Average No. of anal rays.	No. of specimens on which averages are based.
Lake Washington	1	14	47
Mission *a*	1	19	79
Newaukum River	204	15	3
Skookumchuck River	204	16	13
Umatilla *a*	300	19	10
Umatilla	300	18	12
Wallula	326	17	6
Pasco	375	18	3
Lewiston	750	18	16
Pendleton	1,070	14	26
Kamloops *a*	1,158	20½	2
Potlatch Creek at Lewiston	1,200	17	4
Meyers Falls	1,200	14	21
Sicamous *a*	1,300	17	58
Revelstoke *a*	1,475	14	1
Dart's Mills	1,850	13	70
Griffin Lake *a*	1,900	15	14
Spokane River, Spokane	1,910	14	11
Hangman Creek, Spokane	1,910	15	11
Newport	2,000	15	8
Sand Point	2,100	15	67
Snake River, Payette	2,150	18	10
Payette River, Payette	2,150	16	154
Caldwell *a*	2,372	18	34
Caldwell	2,372	16	65
Golden *a*	2,550	16	18
La Grande *a*	2,786	16	23
Flathead Lake	3,100	15	11
Post Cr ek	3,100	15½	6
Silver Bow	5,344	14	14

a These data are from Dr. Eigenmann's paper.

Comparing these with Eigenmann's results, it will be seen that the average number of rays from our *lowest* elevation (14 at Lake Washington) is fewer by 2 than the average from his *highest* elevation (16 at La Grande) and that our average for Newaukum River (204 feet elevation) is fewer than any average found by him except at Revelstoke (1,475 feet), where his average is 15½, and at Griffin Lake (1,900 feet), where it is 15. The average found by us at sea level (Lake Washington) is identical with that found at Silver Bow,* whose elevation is 5,344 feet, the greatest elevation from which specimens have been examined. When there is absolutely no difference between the averages for the lowest and the highest elevations it is not possible for us to see any reason for the generalization, "the higher the altitude the fewer the number of rays." If the figures show anything, they show that the number of anal fin rays does not decrease with increasing altitude. It is also stated that the greatest range of variation is at the lowest altitudes, but further on it is stated that the "greatest variation in this [the Columbia] system was *not* at the lowest altitude, but at an elevation of 2,372 feet." The range here was found by him to be through 10, or from 12 to 21. We find the same range of variation (from 13 to 21) in our specimens from Payette (2,150 feet.) The range found at the point nearest sea level in the Columbia basin (at Umatilla, 300 feet) was only through 6 (15 to 20), and the average for that place is nearly identical with that at Caldwell. The variation found by Eigenmann among his Mission specimens is through 9 (16 to 24), while that of our Lake Washington specimens is through 7 (12 to 18). The averages for these two places, both of which are at sea level, are 19 and 14, respectively.

We consider *Leuciscus lateralis* (Girard) a simple synonym of *L. balteatus.* Our material covers well the type localities of both (Columbia River at Fort Vancouver and Fort Steilacoom on Puget Sound) and indicates but one form. We are certainly not prepared to consider *lateralis* a subspecies of *balteatus,* occupying the same brook with its parent form, as indicated by Eigenmann.

* *L. gilli,* probably a good species.

22. **Coregonus williamsoni** Girard. (Plate 21).

Coregonus williamsoni Girard, Proc. Acad. Nat. Sci. Phila. 1856, 136. Type locality: Des Chutes River, Oregon.

Specimens obtained from the Payette River at Payette, Idaho, 24; Clearwater River at Lewiston, Idaho, 7; Columbia River at Umatilla, Oreg., 1; Natchess River at North Yakima, Wash., 8; Newaukum River at Chehalis, Wash., 4; Little Spokane River at Dart's Mill, Wash., 6; Flathead Lake, Montana, 2; Post Creek, St. Ignatius Mission, Montana, 9; Clarke Fork at Thompson Falls, Mont., 1; Creek at Sand Point, Idaho, 5; Spokane River, Spokane, Wash., 1.

Abundant and widely distributed throughout the Columbia and Upper Colorado and Missouri basins. Specimens of this fish were obtained by Mr. Bean which are of unusual interest in that they show the breeding colors. Mr. Bean's report upon these specimens is given at the end of this paper (pp. 205,206).

23. **Oncorhynchus gorbuscha** (Walbaum). *Humpback Salmon.* The humpback salmon was running in great abundance at the date of our visit to Puget Sound (August 26) and was the only species then being handled at the canneries. We were informed that the humpbacks did not run last year, and in corroboration of the fact that this species runs on the Sound in alternate years only, it is recalled that it did not appear in 1880, when one of us visited this region. As is well known, the female humpbacks are plump, symmetrical, silvery fishes of attractive appearance and good flavor. Aside from the traditional requirements as to color of flesh, the species is well adapted for canning purposes. No young of this species were found in the streams.

24. **Oncorhynchus keta** (Walbaum). *Dog Salmon.* The young of the dog salmon were abundant in the Newaukum and Skookumchuck rivers at Chehalis, Wash. They average slightly smaller than young *quinnats*, and are readily distinguished by their larger eyes. They have 12 or 13 branchiostegal rays, 14 rays in the anal fin, 130 to 135 scales in lateral lines, and 7 + 13 gill-rakers. Like the young *quinnats*, these were all nearly uniform in size, and were evidently young of the preceding year.

25. **Oncorhynchus tschawytscha** (Walbaum). *Quinnat Salmon.* Only the young of the Columbia River salmon were seen by us during our short investigation of the Columbia and the Snake. It had not yet reached its spawning beds on the Snake at the time of our visit, and the "close season" prevented its capture later in the lower river. Such facts as we were able to ascertain concerning its run and spawning-grounds are therefore based on interviews with fishermen and others, a kind of testimony which must, in this case, be scrutinized with more than usual care. On the upper river it was repeatedly found that no distinction was seemingly made between the salmon and the steelhead, and of the two species of salmon that almost certainly spawn in the upper course of these streams, no distinctive accounts could be had. A "silver salmon" was, indeed, frequently mentioned, but we were unable to ascertain whether the fish thus distinguished was the female *quinnat* or the blueback (*O. nerka*).

As already indicated in our notes on the streams, salmon ascend the Snake River to and above the Lower and Upper Salmon Falls, and have important spawning-beds in the main stream, both above and below these falls. They are not known above the Auger Falls, and probably do not even reach the foot of the Great Shoshone. They appear first in this portion of the river early in September, or occasionally in the latter part of August, at a time when the streams are so low that falls or dams which would form no barrier earlier in the season now keep them out from otherwise favorable spawning-beds. This fish is not much used for food in the upper waters. The remnants of the various Indian tribes make yearly visits to the spawning-beds and occasionally white men have tried to put them on the market, but without success. Great numbers, are, however, annually killed through mere love of destruction. The advent of the salmon brings out from every town men and boys with pitchforks or other weapons, curious to see how many of these fish they can destroy. It is to be held in mind that these localities in Idaho and in the eastern portions of Oregon and Washington are so remote from the canneries that the people have no interest whatever in the preservation of the salmon. We can not, therefore, depend upon public sentiment to enforce protective legislation.

We give below such information as we possess concerning the distribution of salmon in the Snake and Upper Columbia rivers.

The principal tributaries of that portion of Snake River which is accessible to salmon are the following: Salmon Falls River or Salmon Creek, Malade River, Bruneau River, Owyhee River, Boise River, Payette River, Salmon River, Grande Ronde River, Clearwater River, and Palouse River.

Beyond the fact that the fish enter Salmon Creek and ascend it for a mile or more, we were able to ascertain nothing concerning the value of this stream.

Malade River is effectually shut off by high falls near its mouth. Trout are said to ascend the stream during high water in the spring, but it becomes impassable later. The stream often goes dry for a distance of many miles along the lower part of its course, and has also other impassable falls in its upper course.

Bruneau River was formerly an important stream for spawning salmon, which reached its head waters in October, according to the statement of Mr. J. L. Fuller, of Bliss, Idaho. We are informed that a dam recently constructed in the Lower Bruneau now wholly prevents the ascent of fish.

The Owyhee River is still open to salmon, so far as could be learned from reports. Mr. J. L. Fuller has seen them in the extreme head waters of the Owyhee in Nevada.

Boise River, like the Bruneau, was formerly a salmon stream, but is now partly or entirely closed by a dam near Caldwell, and is unsuitable by placer mining in the upper part of the stream.

The Payette, Salmon, and Clearwater rivers are all available spawning-grounds for the salmon, and we learned of no obstructions in these streams.

The Grande Ronde River is ascended as far as La Grande, where a dam obstructs further progress.

A high falls at the mouth of the Palouse River prevents the ascent of salmon.

The principal streams and lakes tributary to the Columbia River above the mouth of the Snake are: Yakima River, Wenatchee River, Chelan Lake, Okanagan River, Spokane River, Little Spokane River, Cœur d'Alene Lake, Colville River, Kettle River, and Pend d'Oreille River and its numerous tributary streams and lakes.

Up to 1885 the Yakima River was visited by three or four species of salmon, including the quinnat, in great numbers. Important spawning-beds were located in the bed of the stream; but in recent years but few salmon have made their appearance in this river. No artificial obstructions have been interposed, and the decline can hardly be due to any change in the character of the stream.

We were not able to visit Chelan Lake and Wenatchee and Okanagan rivers, and do not know to what extent salmon frequent these waters. Spokane River, below the falls, was formerly an important salmon stream containing large spawning-beds, but salmon are rarely seen there now. The steelhead still occurs in considerable numbers in the Spokane.

The Little Spokane, as already stated elsewhere, was visited by salmon in great numbers in 1882 and previous years, but since 1882 the number has been very few.

Salmon have never been able to reach Cœur d'Alene Lake, Spokane Falls apparently having proved an effective barrier to their ascent.

Only the few miles of Colville River below Meyers Falls can be reached by salmon, and it is certain that this was formerly an important spawning-ground. The portion of Colville River above the falls would prove excellent for salmon, but Meyers Falls form an absolute barrier. Kettle River flows into the Columbia from the west, just above Kettle Falls. It was not visited by us, and we were not able to get any reliable information regarding it.

The Pend d'Oreille River and the numerous important streams and lakes tributary to it have been discussed elsewhere in this paper. The occurrence of salmon in Kettle River and the lower part of the Pend d'Oreille is dependent upon their ability to ascend Kettle Falls. That salmon formerly reached and ascended the Lower Kettle Falls seems pretty well established; but whether they have ever passed the Upper Kettle Falls is not so certain. The Upper Falls, upon examination, do not appear to be as formidable as the Lower. The fact that so little evidence could be secured regarding the occurrence of salmon in any of these waters renders it highly probable that at no time have they ever ascended in any considerable numbers above the Upper Kettle Falls.

While it is true that the salmon are shut out by falls and dams from a large area of the Columbia and especially the Snake River basins, and while it is also true that the limitations are increasing as streams become useful for irrigation purposes and for mining, it is nevertheless certain that the decrease in the numbers of salmon, due to ill-regulated fishing in the lower Columbia, has so far outstripped the decrease in area of spawning-beds that the latter are now more than ample for all the fish that appear. We do not, therefore, believe that increasing the spawning-grounds through the removal of obstructions would materially benefit the salmon industry. In our judgment, the streams can be repopulated only by regulating the fishing in the lower Columbia and at the same time increasing the output from the hatcheries.

The young of this species were taken in abundance at the mouth of the Natchess River, near North Yakima, Wash., and in the Pataha River at Starbuck, Wash. The largest individual seen was 88 mm. long, the smallest 55 mm.; the average is about 70 mm. These are evidently the young of the previous year, and their uniformity in size indicates clearly that all pass out of the brooks to the sea, or at least to the deeper river channels, during the first and second years. We count in these young specimens 133 to 140 scales in the lateral line, 16 or 17 branchiostegal rays, 7 + 12 gill-rakers, and 15 or 16 rays in the anal fin.

26. **Salmo gairdneri** Richardson. *Steelhead.* The steelhead is an abundant fish in the larger streams of the Columbia basin, especially about Spokane and the mouth of the Pend d'Oreille. Several fine examples of this fish were taken with the spoon by Mr. B. A. Bean in September, 1892, near Spokane. These were called "salmon" by the residents, and Mr. Bean is of the opinion that most, if not all, the "salmon" which they take by trolling are really not salmon, but the steelhead. Mr. Bean was also told that the "salmon" about the mouth of the Pend d'Oreille and Salmon rivers are taken by trolling, and it is quite likely that these also are steelheads.

27. **Salmo mykiss** (Walbaum). *Rocky Mountain Trout; "Sa-pen-gue"* of Fort Hall Indians.

A very large series of trout from the Columbia basin has been examined and from widely separated localities. Specimens were not preserved in every case, but an examination was made of trout from the following places: Snake River at Idaho Falls; Ross Fork and Mink Creek near Pocatello; Little Wood River at Shoshone; Pataha River at Starbuck; Little Spokane River at Dart's Mill; Lake Cœur d'Alene; Lake Pend d'Oreille at Sand Point; Pend d'Oreille River at various places between Newport and the mouth of Salmon River; mouth of Colville River; Newaukum River at Chehalis; Green River at Hot Springs.

With every additional collection of black-spotted trout it becomes increasingly difficult to recognize any of the distinctions, specific or subspecific, which have been set up. The present collection adds not a little to the difficulty. We are now convinced that the greater number of the "subspecies" of *S. mykiss* have no sufficient foundation. We find our specimens from the Upper Snake River (Ross Fork and Mink Creek at Pocatello) to be typical *mykiss*, having small scales, in 176 to 180 transverse rows, and a deep red dash on inner side of mandible. The spots are most abundant posteriorly, and the specimens are scarcely to be distinguished from the so-called *Salmo mykiss pleuriticus* of the Colorado River. When taken in the larger river channels the fish is lighter colored, with finer spots and fainter red mark on lower jaw. Between such typical *mykiss* and the form represented in our collection from such coastwise streams as the Newaukum River at Chehalis, Wash., there seems to be a wide difference. The latter has conspicuously larger scales (in 120 to 130 cross rows) and no red streak on lower jaw. The sea-run individuals of this latter kind we believe to be the steelhead (*S. gairdneri*), and between it and the *mykiss* we are now unable to draw any sharp line. Thus the Wood River specimens have fine scales (150 to 163 transverse rows) and usually no red dash under the jaw. Some specimens show traces of the latter, and in such it is usually faint and irregular.

From the Umatilla River at Pendleton, the Natchess River at North Yakima, and the Pataha River at Starbuck the scales are intermediate in size, ranging from 142 to 163 in number, averaging perhaps 148. In these the lower jaw shows no red. Specimens from the Cœur d'Alene region have the red dashes usually very distinct, but vary greatly in size of scales. Wardner examples look much like typical *mykiss*, with 165 to 170 scales. From Cœur d'Alene Lake we find 130 to 166, with the average about 145, while from the Little Spokane River at Dart's Mill specimens with conspicuous red dash on mandibles have the

scales averaging 125 in number. Trout from the Green River at Hot Springs, Wash., and from the Newaukum River at Chehalis have also 123 to 130 scales. We think it not unlikely that the coastwise form should be recognized as *Salmo mykiss gairdneri*, though the question is sadly in need of systematic and thorough investigation.

The Fort Hall Indians call the trout *Sa-pen-gue*, which, they say, means *good fish*.

28. Salvelinus malma (Walbaum). *Charr; "Salmon Trout"; "Bull Trout."*

Salmo malma Walbaum, Artedi Piscium, 66, 1792. Type locality: Kamchatka.

Abundant in the Pend d'Oreille River. At La Claires we saw in the possession of an Indian several fine specimens, the largest of which was 26 inches long, 11 inches in greatest circumference, and weighed 5 pounds and 1 ounce; the length of the head was 6 inches. The people along the river know this fish as the "charr," while in Montana, from Flathead Lake to Missoula, it is called "salmon trout" or "bull trout." One example was obtained by Bean and Woolman from Lake Pend d'Oreille. One specimen of 3 pounds weight was seen at North Yakima, which had been caught in the Natchess River. *Salvelinus malma* has not yet been found in the Snake River, and it is doubtful if it occurs in that basin above the falls. The only *Salvelinus* yet known in that basin is from Henry Lake, and was identified by Dr. Bean as *S. namaycush*.

29. Columbia transmontana Eigenmann & Eigenmann.

Columbia transmontana Eigenmann & Eigenmann, Science, October 21, 1892. Type locality: Umatilla River, at Umatilla, Oregon.

Seventy-three specimens of this very interesting species were obtained in the Walla Walla River at Wallula, Wash., August 23, 1893, by Messrs. Thoburn and Rutter. The largest specimen measures $3\frac{11}{16}$ inches in total length. Diligent search was made for this fish at the locality where the types were obtained, but none was found. The specimens taken at Wallula were found in only one place, about 250 feet below the railroad bridge, on the edge of a large patch of *Chara* and in water about 3 feet deep, where the bottom was somewhat muddy. The temperature of the water here was 70° at 11:30 a. m., when the air was 80°.

Measurements of the larger specimens give the following results: Head, $3\frac{1}{4}$ to $3\frac{1}{2}$; depth, $3\frac{1}{3}$ to $3\frac{1}{2}$; eye, $3\frac{3}{4}$; snout, 3. D. II, 9; A. II, 6; V. 8; P. 10 to 12. Scales 9-43-8.

Ground color pale straw-color, profusely covered with fine dark-brown specks which form irregular blotches along the course of the lateral line and on median line of back, there being 1 at anterior base of dorsal and 3 or 4 on the caudal peduncle; head with fine dark spots on sides; dorsal, anal, and caudal barred with dark. Dorsal and anal spines strong; the first dorsal spine short, less than length of eye, the second much longer, as long as from tip of snout to middle of pupil; first anal spine scarcely as long as first dorsal; second anal spine about one-third length of head; longest dorsal rays about $1\frac{1}{2}$ in head; those of anal shorter.

30. Gasterosteus microcephalus Girard. Abundant in the Walla Walla River at Wallula, in Lake Washington, and in Skookumchuck River near Chehalis, Wash.; not seen elsewhere by us. Specimens taken were found to be extremely variable in the extent to which lateral shields are developed. In a considerable proportion the plates are developed along the entire length of sides of body and the caudal peduncle is sharply keeled. Others have but 4 or 5 plates developed, the caudal peduncle being then without trace of carina. Between these extremes are all possible intermediate conditions, thus establishing a series comparable with that recently reported on by Dr. G. A. Boulenger as occurring in the common European species.

31. Cottus asper (Richardson). A single specimen, 145 mm. long, from the Walla Walla River at Wallula, Wash., and two small specimens from Lake Washington. The dorsals contain 9 spines and 21 rays, and are slightly connected at base. Soft dorsal high, the longest ray $2\frac{1}{3}$ in length of head, the posterior rays reaching base of caudal. Anal fin with 17 rays; pectorals, 16. Interorbital space very wide, equaling diameter of eye, not concave. Prickles coarser and less closely crowded than in the Sacramento River specimens, distinctly visible without the aid of a lens, and directed upwards and backwards. The lateral line is complete, without abrupt angle under last dorsal rays, and contains 38 pores. Anus separated from first anal ray by a space equaling two-thirds diameter of orbit. Band of palatine teeth weak. Anterior nostril in a short tube. The coarser prickles, more anterior position of vent, and flatter interorbital space probably indicate that *C. asper* is separable, at least subspecifically, from the Sacramento River form. Material is not now at hand to settle this point.

32. Cottus rhotheus (Rosa Smith).

This strongly-marked species is abundant in the Spokane region, and was taken at the following stations: Little Spokane River at Dart's Mill near Spokane, and at Chattaroy, Wash.; Columbia River at Colville, Wash; Cœur d'Alene Lake near Cœur d'Alene, Idaho; Clearwater River near Lewiston, Idaho; Walla Walla River at Wallula, Oreg.; Hangman Creek at Tekoa, Wash.; Natchess River at North Yakima, Wash.; Newaukum River near Chehalis, Wash.; Snoqualmie River at Snoqualmie Falls, Wash.

The salient features of this species are: (1) The pointed wedge-shaped profile of head, as viewed from above; this contrasting strongly with the usual broadly-rounded contour of other species. (2) The wide horizontal mouth, quite at lower profile of head. (3) The noticeably concave interorbital and occipital regions. (4) The very broad and long palatine band of teeth. (5) The rather slender body and the extremely slender caudal peduncle, the latter expanding fan-like at base of caudal fin. (6) The dorsals usually separate; when united, at extreme base only. (7) Lateral line complete. (8) Sides usually well invested with prickles, which are triangular and coarse, and less closely placed than in *asper*. They are arranged more or less definitely in oblique series. There is considerable variation in the completeness of the investment, and in one specimen from Chehalis an axillary patch only is present.

The specimens from Chattaroy and from Snoqualmie Falls are referred to this species with doubts as to their identity.

The following table will give an idea of the amount of variation in number of fin-rays, found in this species:

Locality.	Spinous dorsal.		Soft dorsal.		Anal.			Pectoral.		Lateral line.
	VII.	VIII.	16	17	11	12	13	15	16	
Little Spokane River	4	6	6	4	3	6	1	......	10	32 to 34
Natchess River	......	2	2	......	......	1	1	......	2	32, 33
Newaukum River	......	2	1	1	1	......	1	2	......	......
Walla Walla River	1	2	1	2	1	2	......	......	3	......
Colville River	......	1	1	......	......	1	......	1	......	......
Tekoa	1	5	5	1	1	4	1	......	......	......
Cœur d'Alene	1	4	3	2	3	2	......	......	5	......
Lewiston	......	1	1	......	......	1	......	......	1	......

33. Cottus punctulatus (Gill). *Ah-we.*

Cottopsis semiscaber Cope. Hayden's 5th Report, 1871, 476. Type locality: Fort Hall, Idaho.

Numerous specimens from Green River, Wyoming. Comparing these with typical *semiscaber* from the vicinity of Pocatello, Idaho, we can appreciate no difference whatever, except in the matter of armature. None of our Green River specimens show any prickles whatever. About half the Pocatello specimens are also naked and are indistinguishable from typical *punctulatus;* in the others more or less prickles are developed, varying from a few in axil of pectorals to a band covering more than half of the sides. As this is not an unusual amount of variation, we do not consider *C. semiscaber* worthy of recognition. The relations of *C. punctulatus* with the eastern species have not been carefully worked out, and it seems best to recognize it for the present as distinct. Specimens from Green River, Wyoming, and from Mink Creek, Ross Fork, and Port Neuf River, Pocatello, Idaho. The collection contains also two specimens from Thompson Falls and three from Flathead Lake, which seem to be this species. By the Fort Hall Indians this fish is called *ah-we,* a word meaning *horns.*

34. Cottus perplexus, sp. nov. (Plate 20.)

Type locality: Skookumchuck River, near Chehalis, Wash., where 13 specimens were collected, August 28, 1893, by Drs. Gilbert and Jenkins. Associate type locality: Newaukum River near Chehalis, Wash.; 26 specimens, collected by Drs. Gilbert and Jenkins, August 28, 1893. Type, No. 45387, U. S. Nat. Mus. Co-types, No. 45388 (Newaukum River), U. S. Nat. Mus.; and Nos. 1324 to 1343 (Skookumchuck River), Museum Leland Stanford Junior University. Related to *Cottus punctulatus.*

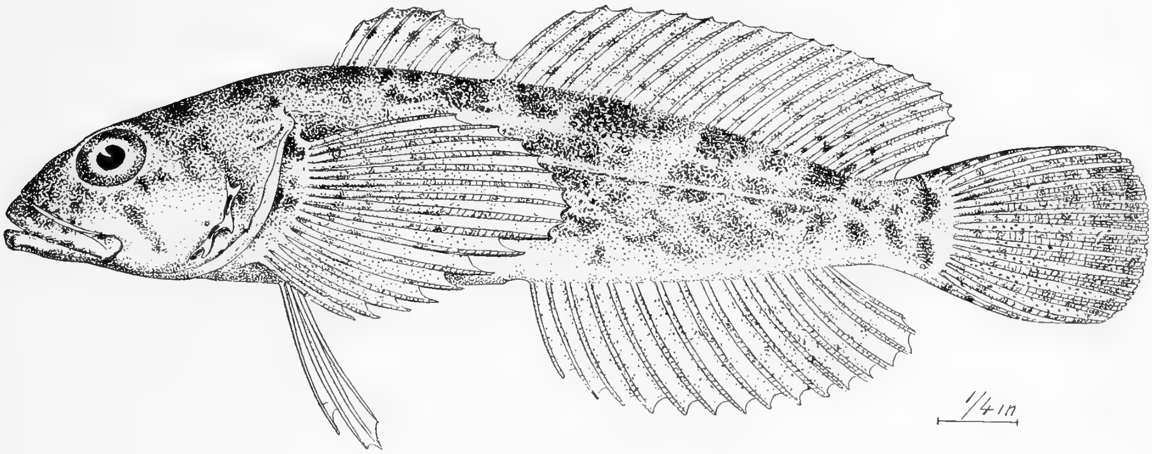


Fig. 1. COTTUS PERPLEXUS, sp. nov. (Type.) Skookumchuck River, Chehalis, Washington.

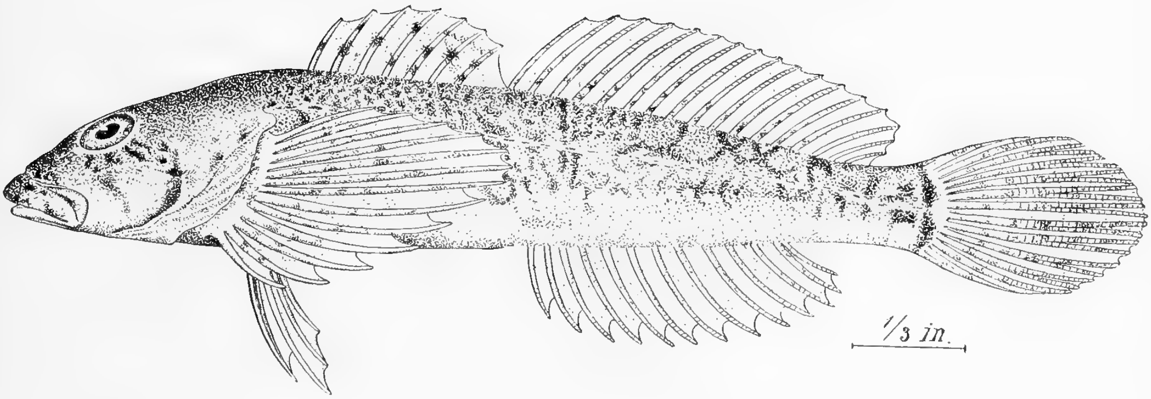


Fig. 2. COTTUS LEIOPOMUS, sp. nov. (Type.) Little Wood River, Shoshone, Idaho.

Description: Head, $3\frac{1}{5}$; depth, $4\frac{1}{5}$; eye, 4; snout, 4; interorbital width, $5\frac{1}{2}$. D. VII, 21; A. 15; P. 16; V. I, 4. Least depth of caudal peduncle greater than snout, $3\frac{3}{5}$ in head; interorbital space rather broad, about $1\frac{1}{3}$ in eye.

The body is deeper and more compressed than in any other species known to us, this being especially noticeable posteriorly; the caudal peduncle is very short and deep, and is entirely overlapped by the posterior dorsal rays which extend beyond base of caudal fin. Length of caudal peduncle from base of last dorsal ray about $\frac{3}{4}$ depth of same. Depth of body at origin of anal fin $\frac{3}{5}$ length of head. Interorbital space slightly concave; occiput flat or transversely convex. Mouth oblique, the maxillary reaching vertical from posterior margin of pupil, $2\frac{1}{3}$ in head. Teeth in a very narrow crescentic band on vomer, none on palatines. Upper preopercular spine short and broad, curved or simply directed upward; below this two stout, blunt spines directed downward. Body, in the type specimen, entirely naked; lateral line incomplete, not reaching end of soft dorsal.

Spinous dorsal low, the longest spines not greater than length of snout; soft fins all high, the 15th dorsal ray equal to snout and eye; a broad membrane always connecting the two dorsals, the notch inconspicuous. Last rays of anal as well as dorsal extend beyond base of caudal; first anal ray under third ray of soft dorsal; ventral spine and rays slender and weak. Anus midway between base of caudal fin and front of eye.

Color in alcohol, back and sides with vermiculations of light and dark, the back with 5 or 6 ill-defined black crossbars, which usually reach the lateral line; the usual black bar at base of caudal, emarginate posteriorly; below the lateral line a number of small, quadrate, dark blotches, arranged in two irregular series; lower parts unmarked except with fine dark punctulations; dorsal, pectoral, and caudal fins crossbarred with dark; anal and ventrals with numerous small dark specks. Length, 91 mm.

The co-types show that this species is subject to some variations which should be mentioned. Head, 3 to $3\frac{1}{5}$; depth, $4\frac{1}{5}$ to $4\frac{1}{2}$. D. VII or VIII, 18 to 21; A. 14 to 16; P. 14 to 16. While the body is usually entirely naked, there is occasionally an axillary band of prickles, sometimes supplemented by a single irregular series of prickles along base of the dorsal fin. The notch in the membrane connecting the dorsals is usually inconspicuous. In some examples the black crossbars on the back do not reach the lateral line. The small, quadrate, dark blotches below the lateral line are sometimes arranged in a single series parallel with base of anal, sometimes in two irregular series.

The following table gives the fin formula in a number of individuals of this species:

Locality.	Dorsal spines.		Dorsal rays.				Anal rays.			No. of specimens examined.
	VII.	VIII.	18	19	20	21	14	15	16	
Skookumchuck River	3	10	4	5	2	2	6	6	1	13
Newaukum River	3	2	2	2	......	1	1	3	1	26
Natchess River	4	1	1	3	1	......	2	2	1	5

From *Cottus punctulatus*, which it most closely resembles, this species may be distinguished by its deeper body, more elongate anal fin, the broad union between the dorsals, the absence of palatine teeth, and the different coloration.

35. **Cottus leiopomus** sp. nov. (λεῖος, smooth; πῶμα, cover, opercle.) (Plate 20.)

Type locality: Upper Little Wood River, Shoshone, Idaho, where 2 specimens were collected, September, 1893, by Mr. H. H. Kinsey. Type, No. 45389, U. S. Nat. Mus. Co-type, No. 1151, Museum Leland Stanford Junior University. Related to *Cottus philonips*.

Head, $3\frac{1}{2}$; depth, $5\frac{1}{2}$; eye, $4\frac{3}{5}$; snout, $3\frac{1}{6}$; interorbital width, $7\frac{1}{4}$; D. VII–17; A. 12; P. 13; V. I, 4. Least depth of caudal peduncle about equal to length of snout; interorbital space very narrow, much less than diameter of eye; mouth small, maxillary reaching vertical from middle of eye, a wide strip visible laterally in the closed mouth. Preopercular spines entirely absent, the preopercular margin evenly rounded throughout, without prominence, and without the least trace of a spine.

Vomer with a very narrow band of teeth; palatines naked; skin wholly naked, lateral line complete. Dorsal fins not joined unless at extreme base; fins all low, the pectorals barely reaching front of anal; front of anal under third ray of second dorsal, its last ray under fourth from last ray of latter. Free portion of caudal peduncle (behind last anal ray) contained $1\frac{2}{3}$ in head; portion behind base of last dorsal ray 3 in head; neither dorsal nor anal reaching base of caudal when depressed.

Color in alcohol: head on sides rather finely vermiculated with light and dark; plain whitish below; not coarsely spotted or blotched as in *philonips;* dorsal bars indistinct; two narrow black lines downward and backward from the eye; an evenly convex dark bar at base of caudal; dorsals, pectorals, and caudal faintly crossbarred.

Length 81 mm.

The second specimen, which is 71 mm. long, agrees closely in every respect with the type.

This species is very closely related to *Cottus philonips*, from which it differs only in the total absence of any preopercular spine. In both specimens, and on each side, the preopercular margin is entirely rounded throughout, without any prominence and without the least trace of a spine. It seems very improbable that the two should agree in being merely abnormal in this respect, and we are forced to conclude that a form exists which is peculiar to the Malade River, a stream otherwise remarkable in its ichthyologic features.

36. **Cottus philonips** Eigenmann.

This name was proposed as a substitute for *Cottus minutus* Pallas, supposed to be preoccupied, and *Cottus microstomus* (Lockington), not of Hæckel. The first mentioned is perfectly available, but was applied to a specimen from the island of Talek, near Tanisk, in the Okhotsk Sea. It is very doubtful, therefore, whether *C. minutus* should be used for any American species in advance of comparison with the Siberian form. From the Aleutian Island species (*C. microstomus* Lockington), *C. philonips* differs in many important respects, and is undoubtedly distinct. Thus the Alaskan form has the posterior nostrils in short but conspicuous tubes, the preorbital produced into a lobe which conceals all of the maxillary except the extreme tip, and the dorsal fin with 8 or 9 spines and 18 to 20 soft rays.

Cottus philonips is a small-headed form, typically with perfectly smooth skin and unarmed palatines. Like most other species of the genus it occasionally develops a band of postaxillary prickles, which are often accompanied in the same specimens by a small patch of teeth on the palatine bones. The head is less strongly armed than usual, the single preopercular spine being short, the preopercular margin otherwise wholly unarmed. In this respect *C. philonips* differs from all other western species of *Cottus*, except the Alaskan form above mentioned.

The dorsal varies from VII or VIII, 16 to 18; the anal from 12 to 14. The nostrils are without tubes, and the preorbital little produced, exposing the greater part of maxillary in closed mouth.

Specimens were obtained in the Port Neuf River near Pocatello, at Snoqualmie Falls, and in a spring branch emptying into the South Fork of the Cœur d'Alene River, near Wardner, Idaho. We have also seen specimens taken from Birch Creek, in western Idaho, by Merriam and Bailey.

37. **Cottus marginatus** Bean.

Six small specimens from Mill Creek at Walla Walla (the type locality of *marginatus*) agree with Bean's description and differ from all other western specimens of *Cottus* which we have seen in having but three soft rays in the ventral fins. So far as can be ascertained from our very immature specimens, *marginatus* strongly resembles *perplexus*, with which it agrees in fin rays, naked skin, the incomplete lateral line, and the absence of palatine teeth. *C. perplexus* has constantly 4 soft rays in the ventral fins, and other differences may appear when compared with adult specimens. In our specimens of *marginatus*, the anus varies in position, being sometimes nearer base of caudal fin than snout, sometimes nearer snout. Twenty-two small specimens, collected by Bean and Woolman at Sand Point, Idaho, are for the present referred to this species, though we are not certain that this identification is correct. The ventrals seem to be I, 3, but the body is more or less covered with prickles.

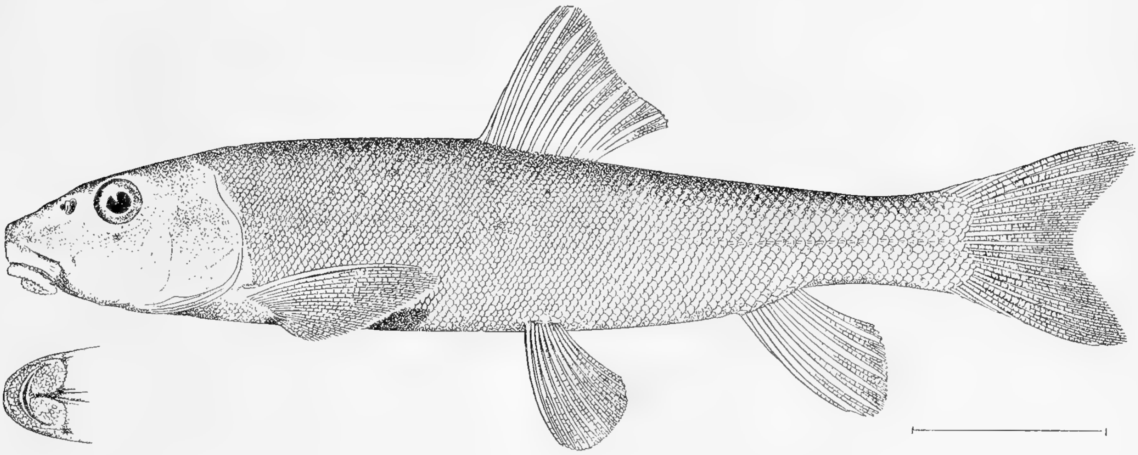


Fig. 1. CATOSTOMUS POCATELLO, sp. nov. (Type.) Ross Fork of Snake River, Pocatello, Idaho.

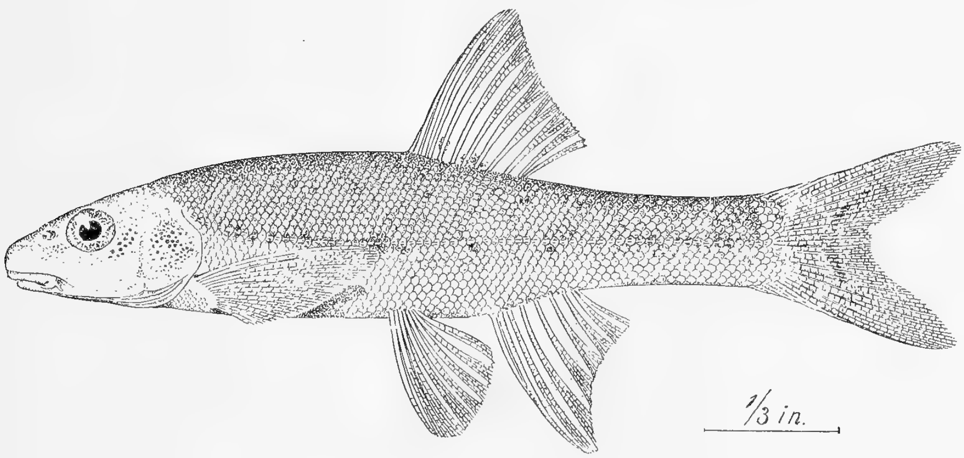


Fig. 2 AGOSIA UMATILLA, sp. nov. (Type.) Columbia River, Umatilla, Oregon.

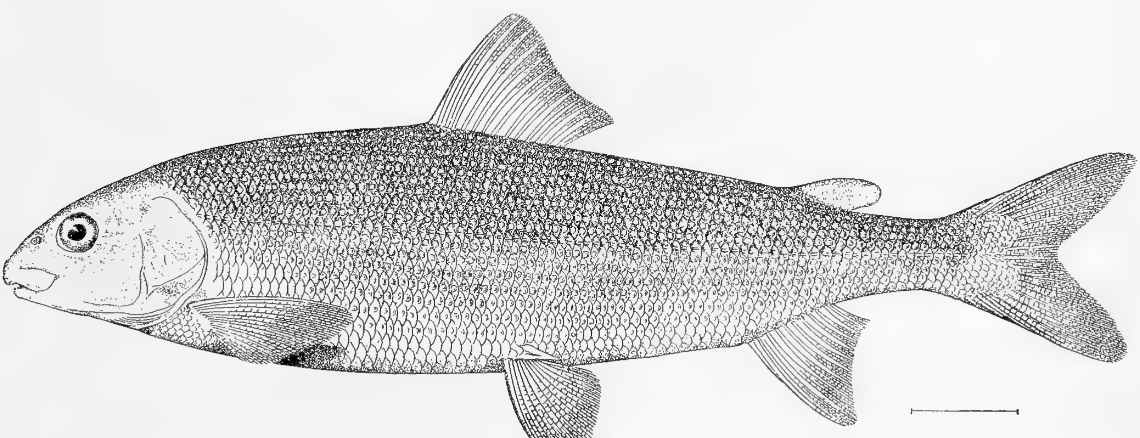


Fig. 3. COREGONUS WILLIAMSONI Girard. Breeding male. Little Spokane River, Washington.

NOTES ON WILLIAMSON'S WHITEFISH IN BREEDING COLORS, FROM LITTLE SPOKANE RIVER, WASHINGTON, AND REMARKS ON THE DISTRIBUTION OF THE SPECIES.

[By Barton A. Bean, assistant curator, Department of Fishes, U. S. National Museum.]

In the fall of 1892, while on an investigation of the streams in eastern Washington with a view of locating a site for a fish-hatchery for the U. S. Fish Commission, the writer had the good fortune to secure a very fine specimen of *Coregonus williamsoni* approaching the breeding condition.

As will be seen in the accompanying illustration (Plate 21) the tubercles on the scales at this time are very prominent, situated on the middle of the scales, milk-white in color, and forming horizontal lines along the body from head to tail. About sixteen of these lines can be counted between the back and ventral edge of the body. The tubercles show on the abdomen, but the color of that portion of the body and of the tubercles being similar, they are indistinct.

Color: Dark on back, sides a lighter steel-gray, and under parts white; all fins tipped with black; caudal and adipose fins steel-blue.

D. 14; A. 13; scales, 9–83–10; pores in lateral line, 80; head, 5; depth, 4; eye, $4\frac{1}{3}$; snout, 3. Gill-rakers short, about 12 below the angle. Mouth very small, the maxilla barely reaching vertical through front of eye. Dorsal fin highest in front, gradually graduated to last ray, which is less than one-half length of anterior rays. The greatest height of the dorsal slightly exceeds its length of base, which equals the length of the ventral fins, being considerably less than the length of the pectorals, but exactly that of the anal fin. Caudal fin deeply forked.

The specimen here described and illustrated measures not quite 11 inches; it is a male and was taken in Little Spokane River near Clark Springs, October 5, 1892.

Another example, a little larger ($12\frac{1}{2}$ inches), was obtained by Mr. A. J. Woolman in the Little Spokane, in September, 1892. The tubercles on this specimen are well preserved, those on the former having disappeared owing to exposure to the air and handling while being drawn.

Mr. Woolman's example has the following characters: D. 13; A. 13. Scales 10–80–10. Head, 5; depth, 4. Adipose fin very long, the length of its base being contained $2\frac{1}{2}$ times in the head's length. Color as in the preceding.

So far as we are aware the breeding whitefish, of any species, has not been heretofore described in America. In Faune des Vertebres de la Suisse, volume V, Hist. Nat. des Poissons, Génève, 1890, Dr. Victor Fatio presents the following note on the breeding colors of *Coregonus exiguus* of Switzerland:

> Adult males differ from the females by a more slender body, larger head, stouter muzzle of snout, the greater development of the paired fins, especially the pectorals, and during the breeding season by a more intense coloration, also by the stronger and more numerous epidermic buttons, and sometimes by the more strongly arched scales on the lateral line.

It is unfortunate that we failed to secure female fish. The whitefish were very abundant in the Little Spokane; large numbers were observed. They were, however, exceedingly shy and difficult of capture, and our efforts to net them were entirely ineffectual.

In most of the streams seined by Mr. Woolman and the writer in western Montana, Idaho, and Washington the young, parr-marked whitefish was taken. These young fish were obtained in several quiet streams, almost sluggish, so weak was the current. In Spokane River at the city of Spokane large numbers of adult whitefish could be seen from the city bridges. They would lie or swim close to the bottom, keeping in the shade of the bridges, and would bite at grasshoppers. The artificial fly seemed to have no attraction for the fish.

This whitefish grows to a length of 15 inches, has excellent flesh, and is by many confused with the grayling, *Thymallus*. The Columbia River chub, *Mylocheilus caurinus* is often called "whitefish." The type of *Coregonus williamsoni* was obtained in the Des Chutes River, Oregon, and described by Dr. Girard in the Proceedings of the Philadelphia Academy of Sciences in 1856, and again in 1858 in the Pacific Railroad Survey reports. Later recorded localities are: Willamette and Columbia rivers, Oregon; the Columbia and its tributaries in Washington; Lake Tahoe, Trout Creek and Truckee River, California; lakes and streams of Idaho, Montana, Wyoming, Colorado, and Utah. The species ranges north into British America and eastward to the mountain tributaries of the Upper Missouri, several of the localities given by Prof. Evermann being east of the Continental Divide.

ANNOTATED LIST OF REPTILES AND BATRACHIANS.

[By John Van Denburgh, student, Leland Stanford Junior University.]

But few reptiles and batrachians were observed by members of the expedition, partly because no special effort was made to collect them, and partly because they were not abundant in most of the region traversed. Both lizards and snakes seemed to be rare on the barren lava plains of the Snake River, where *Sceloporus graciosus*, *Phrynosoma douglassi*, and *Phrynosoma platyrhinus* were the only species seen. The case was different in the bottom lands of the Snake River below Shoshone Falls, Idaho. Here lizards were extremely abundant and in considerable variety. Species of *Uta*, *Crotaphytus*, and *Cnemidophorus* were as numerously represented as on the hot deserts of southern California. Two species of *Sceloporus* were also seen, but of these no specimens were secured. The richness of reptilian life on the sandy floor of the valley contrasted strongly with the reverse condition on the lava plains immediately bordering the valley and but a few hundred feet above it.

1. **Crotaphytus wislizenii** Baird & Girard. Two full-grown specimens collected in the bottom lands of the Snake River near Bliss, Idaho, August 8. With the exception of *Cnemidophorus tigris*, this was the most abundant species observed.
2. **Uta stansburiana** Baird & Girard. A single badly mutilated specimen from Snake River bottoms, near Bliss, taken August 8. The species was not rare, and was usually observed on rocks.
3. **Sceloporus graciosus** Baird & Girard. Six specimens from near Pocatello, Idaho, August 3; two specimens from near Idaho Falls, Idaho, August 5; three specimens from near Umatilla, Oreg., August 11. This species was always observed on the ground, and was seen both among the coarser basalt and on the finer sands and gravels.
4. **Phrynosoma douglassii** (Bell). This pygmy horned toad seemed by no means abundant. The largest specimen, 68 mm. long, was taken at Pocatello, Idaho, August 4. Two other specimens were captured: one on the Clearwater River, 7 miles above Lewiston, August 15; the other at North Yakima, Wash., August 23.

5. **Phrynosoma platyrhinos** Girard. One specimen from Bliss, Idaho, August 8; two—a male and a female—from the lava plains between Shoshone and the Snake River, August 7. In the latter locality the species was abundant. The two specimens there secured have the series of enlarged gulars almost obsolete, it being represented on each side by two or three scales slightly more pointed than the other gulars. The number of femoral pores is 8 in the male, 10 in the female. The tympanum is fully scaled in one, only partially so in the other.

6. **Cnemidophorus tigris** Baird & Girard. The "sand lizard" was the most abundant species in Snake River bottoms. A single specimen was collected near Bliss, Idaho, August 8. This seems not to differ from Owen's valley specimens, and we therefore follow Dr. Stejneger in the use of the above name.

7. **Thamnophis vagrans** (Baird & Girard). Although the six garter snakes brought in by the expedition show considerable color variation, they unquestionably represent a single species. They were collected at the following localities: 1 specimen, Sand Point, Idaho, August 7; 2 specimens, Clearwater River near Lewiston, Idaho, August 15; 1 specimen, Potlatch Creek near Juliaetta, Idaho, August 16; 1 specimen, Wardner, Idaho, August 18; 1 specimen, Umatilla, Oregon, August 23.

8. **Thamnophis sirtalis parietalis** (Say). One specimen of this variety was obtained on the Little Spokane River near Spokane, in September, 1892, by Mr. A. J. Woolman.

9. **Crotalus lucifer** Baird & Girard. A single specimen taken on the Snake River between Twin Falls and Shoshone Falls, Idaho. The rattler is said to be not abundant in that vicinity.

10. **Diemyctylus torosus** (Esch). Two specimens found in Skookumchuck River near Chehalis, Wash., August 28.

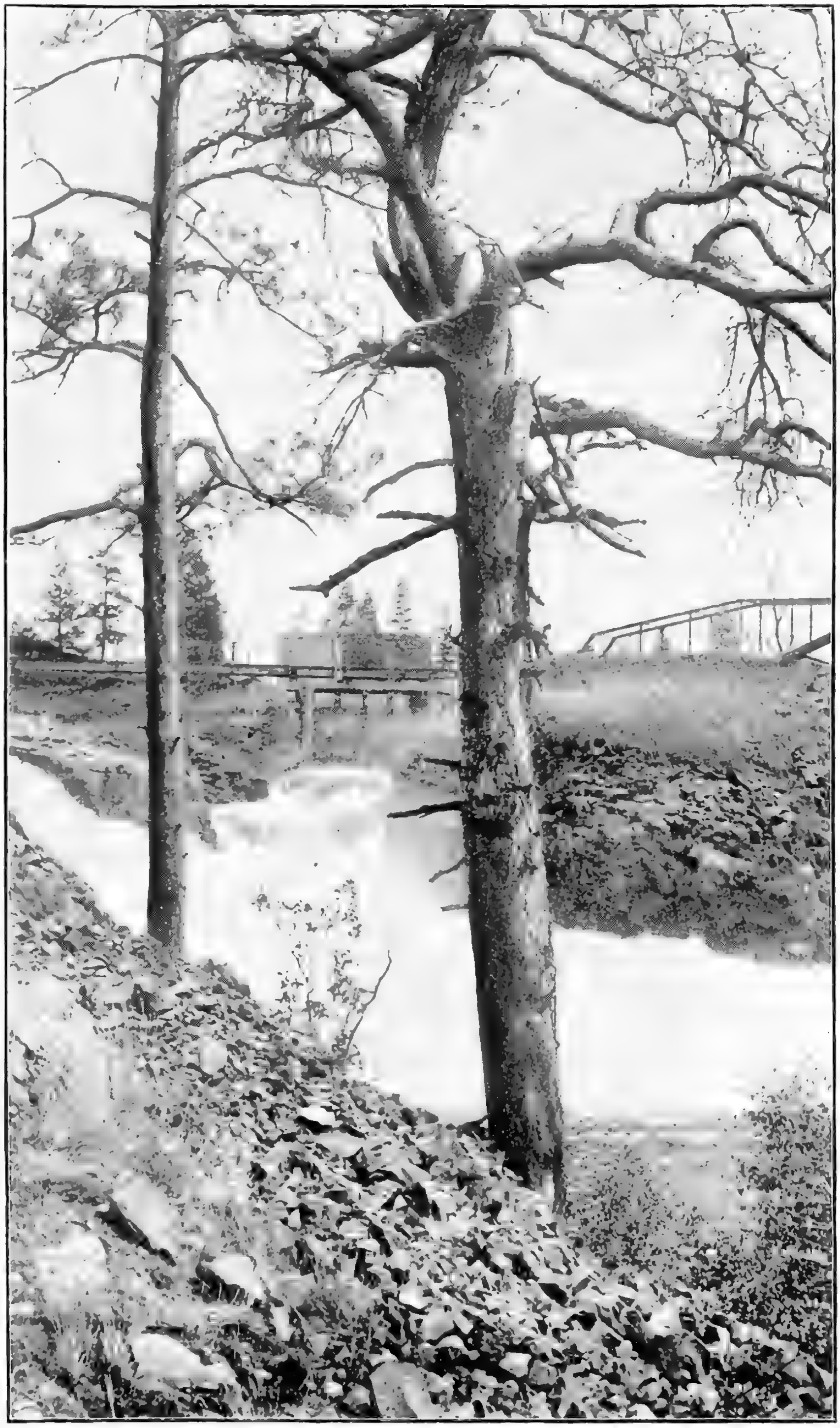
11. **Bufo columbiensis** Baird & Girard. One young specimen, Umatilla, Oregon, August 23, and one adult, Pocatello, Idaho, August 3.

12. **Hyla regilla** Baird & Girard. One specimen, Chehalis, Wash., August 28.

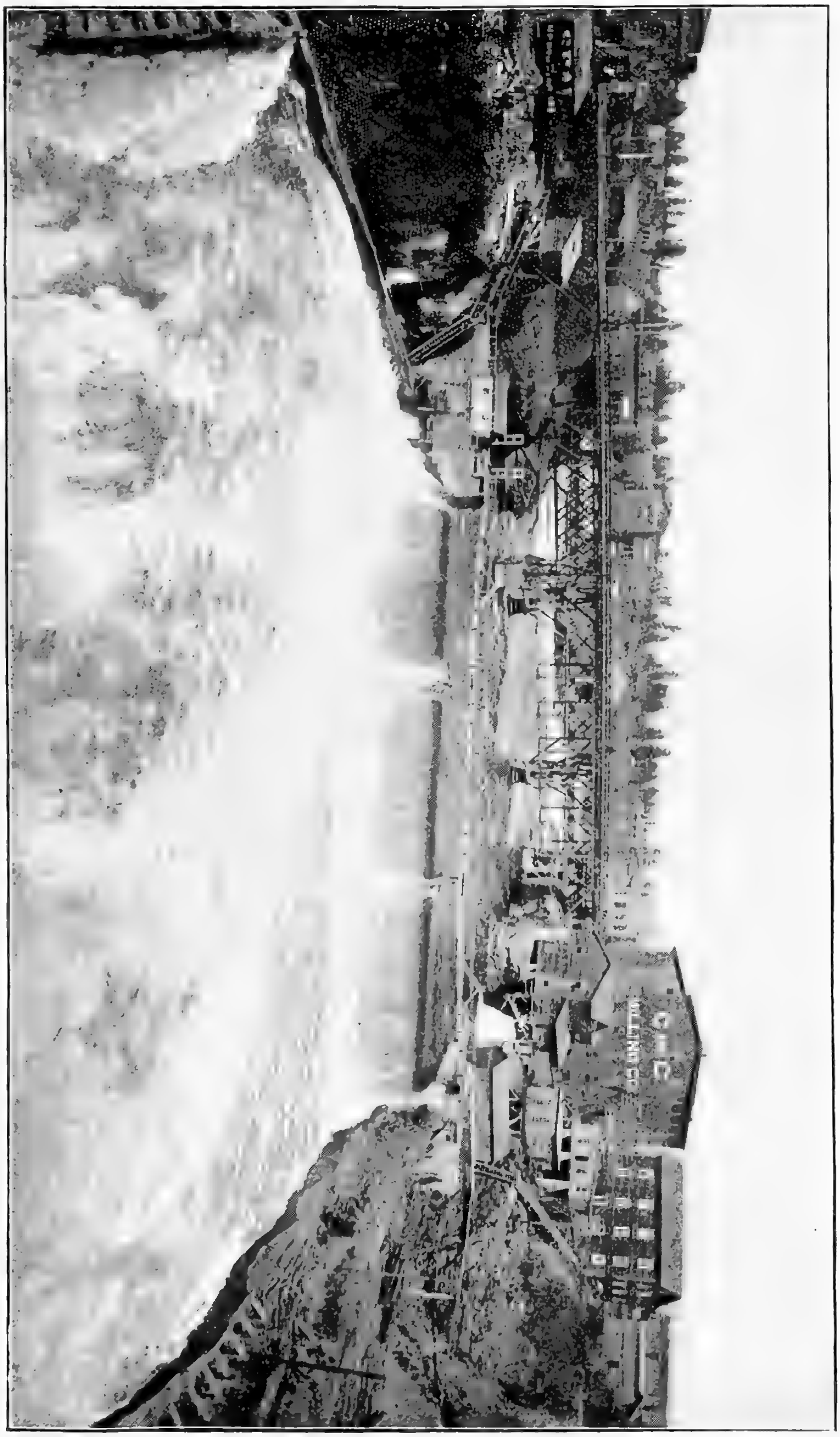
13. **Rana aurora** Baird & Girard. Four specimens from Skookumchuck River near Chehalis, Wash., August 28.

14. **Rana pretiosa** Baird & Girard. Seven specimens, Sand Point, Idaho, August 7; 1 specimen, Pendleton, Oreg., August 12; 2 specimens, Colfax, Wash., August 17; 1 specimen, Little Spokane River, Dart's Mill, Washington, August 18; 4 specimens, Cœur d'Alene, Idaho, August 21; 1 specimen, Post Creek, Montana, September 18, 1892; 1 specimen, Thompson Falls, Montana, September 19, 1892; 5 specimens, Sand Point, Idaho, September 20, 1892; 7 specimens, Little Spokane River, Spokane, Wash., September, 1892; 3 specimens, Clark Spring, Spokane, Wash., October 5, 1892.

15. **Rana pipiens brachycephala** (Cope). One specimen of this handsome frog was secured in the Boise River, at Caldwell, Idaho, August 8. The collection made by Messrs. Bean and Woolman contains three specimens from Post Creek, Montana (September 18), and one from Sand Point, Idaho (September 20).

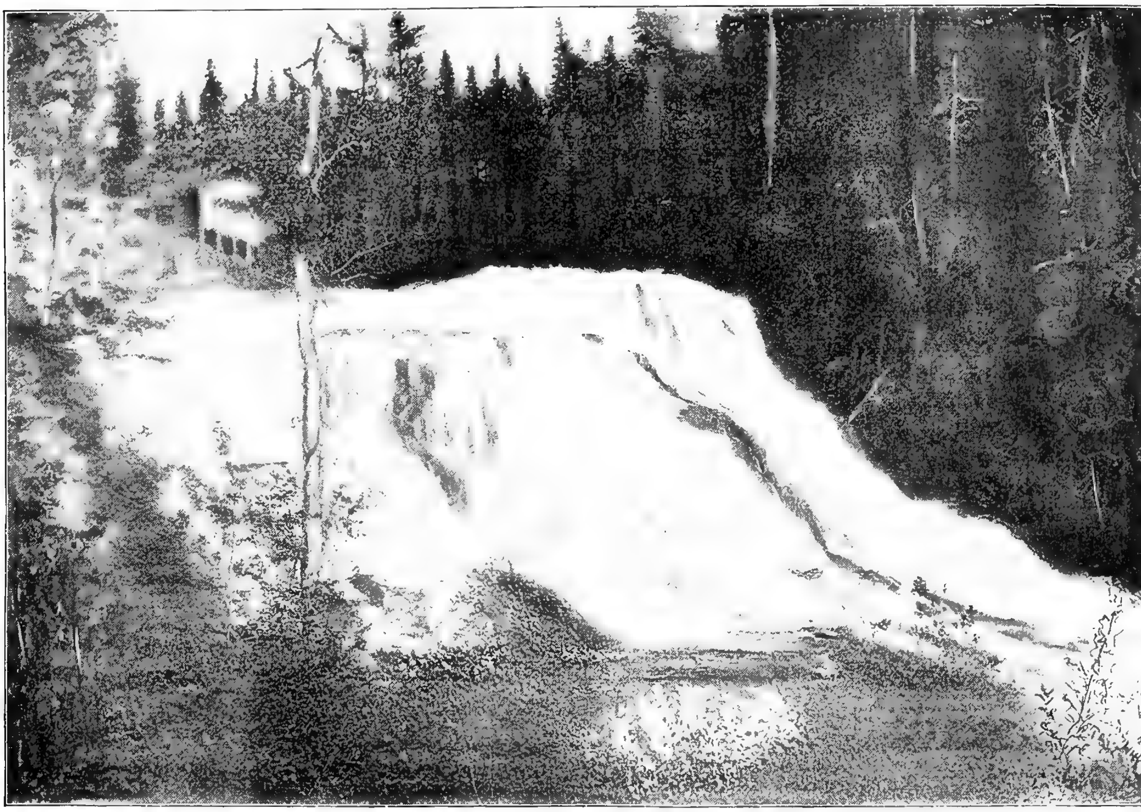


SPOKANE FALLS, SPOKANE, WASHINGTON. PART OF THE UPPER FALLS.



SPOKANE FALLS, SPOKANE, WASHINGTON. FROM MONROE STREET BRIDGE.

UPPER SPOKANE FALLS, SPOKANE, WASHINGTON. FROM POST STREET BRIDGE.



MYERS FALLS, COLVILLE RIVER. TOTAL DESCENT ABOUT 80 FEET.

LOWER KETTLE FALLS, COLUMBIA RIVER.

17.—NOTES ON FISHES COLLECTED IN FLORIDA IN 1892.

By Dr. JAMES A. HENSHALL.

During the months of January, February, and March, 1892, the writer was engaged in collecting a series of the salt-water fishes of Florida for use in preparing the exhibit of the U. S. Fish Commission at the World's Columbian Exposition, Chicago, 1893.

Most of the fishes were procured from the fishermen at Tampa and Key West. As it was intended to make gelatin casts of those obtained, only adult examples were collected, comprising the larger forms, especially those known as food-fishes; consequently such small species as cyprinodonts, sardines, anchovies, silversides, etc., were not embraced in the collection.

Each fish was taken fresh from the water, frozen in a refrigerator, and then carefully wrapped in soft, white paper, and sewed up in cheese cloth. They were then packed in ice and shipped to Washington by express, where they arrived in excellent condition. Those shipped from Key West were re-iced en route at Port Tampa.

Casts were made of most of the species, which were painted in oil from fresh examples or color sketches and exhibited at the World's Fair, where they were very much admired and presented so lifelike an appearance that most visitors mistook them for real fishes.

The fishing in the vicinity of Tampa is all done by means of haul seines on the sandy beaches of the islands and bays of the mainland. The first pound net on the west coast of Florida was put in operation in Sarasota Bay during my visit, from which I secured many fine specimens.

The coralline formation of the Florida keys and reefs renders the use of seines and nets impossible, so that all of the market fishing at Key West is done with hook and line. Most of the fish are bottom fish, and are caught in the channels between the keys, the fleet of small smacks (known as "smackees") going out every morning and returning in the afternoon. The fish, consisting of grunts, snappers, groupers, porgies, etc., are brought to market alive in the wells of the smackees. The principal and favorite bait is the sea crawfish (*Palinurus* sps.), but such small fry as pilchards, sardines, anchovies, etc., are also used.

A fleet of larger smacks, mostly schooner-rigged, engage in trolling along the keys and reefs for the larger surface-feeding fishes, as kingfish, Spanish mackerel, jacks, albicore, bonito, etc. The troll used is usually a piece of bacon rind cut in the semblance of a fish. The catch is taken to market fresh, but not alive, as the severe ordeal of being hooked and hauled in while under sail is usually sufficient to cause the death of the fish in a short time. They are, therefore, rapped on the head and killed outright as soon as they are brought aboard.

The following list of 131 species comprises the collection under consideration. As their specific characterizations are published elsewhere, the annotations are from an economic standpoint entirely, it being the intention to give only such information as relates to their habitat, abundance, size, habits, and their comparative value as food-fishes. The vernacular names given are those used by the fishermen.

SPHYRNIDÆ.

1. Sphyrna tiburo (Linn.). *Bonnet-head Shark.* This curious shark is common about the Florida keys and at the passes and inlets of both coasts. It grows to about 6 feet in length. It is of no economic importance. I obtained several small examples about 3 feet long at Tampa and Key West.

PRISTIDIDÆ.

2. Pristis pectinatus Latham. *Sawfish.* Common on both coasts of Florida in the bays and along the keys. It grows to a length of 20 feet. No use is made of it except that its saw is preserved and sold as a curiosity. It is viviparous, the young being some 2 feet in length when born. It does considerable damage to turtle nets and other set nets by becoming entangled in the meshes, and is capable of inflicting severe wounds with its saw, if interfered with. On this account it is always killed by the fishermen when captured; but the prevalent stories of the books alleging that the sawfish uses its saw as an offensive weapon in procuring food by cutting, slashing, and tearing other fishes must be taken *cum grano salis.* I have seen hundreds of sawfishes, big and little, engaged in procuring food by raking the sand of the bottom, but I have never observed them using the saw to disable other fishes. The character of its minute teeth indicates that its food consists of small organisms. It is a bottom feeder, like all of the rays. I obtained a specimen 8 feet in length at Tampa.

RHINOBATIDÆ.

3. Rhinobatus lentiginosus Garman. *Electric-fish.* Not uncommon about the Florida keys. It grows to several feet in length. It is called the "electric fish" by the fishermen, who ascribe to it considerable electric powers. I failed to secure a living specimen in order to test the matter, though I obtained several adult examples about 2 feet long at Key West and one at Tampa.

DASYATIDÆ.

4. Pteroplatea maclura (Le Sueur). *Butterfly Ray.* Common in the bays of the west coast. It is of no economic importance. I obtained several specimens a foot or two in diameter in Sarasota Bay.

5. Dasyatis centrura (Mitchill). *Stingaree.* Common in the bays of both coasts. The fishermen dread the largest ones, as its "sting" (serrated spine) is supposed to be poisonous. At all events it is capable of causing a very serious wound. I procured several examples at Tampa, and one in Sarasota Bay that measured 6 feet across the pectorals.

6. Dasyatis sayi (Le Sueur). *Stingaree.* Not uncommon about the southern keys and the inlets of the coasts. I obtained one at Mullet Key, near the entrance to Tampa Bay. The sting-rays are not utilized in any way in Florida.

7. Dasyatis sabina (Le Sueur). *Stingaree.* Common in the bays and lagoons of both coasts, often running up the streams to fresh water. I obtained several small ones in Tampa and Sarasota bays.

MYLIOBATIDÆ.

8. Stoasodon narinari (Euphrasen). *Whip Ray.* Not uncommon on the west coast. It is a very handsome ray, being dark brown and thickly covered with white spots a half inch to an inch in diameter. The long tail is preserved as a curiosity. I procured a fine example, some 4 feet in diameter, from Sarasota Bay.

SILURIDÆ.

9. **Galeichthys felis** (Linn.). *Catfish.* Abundant everywhere along the coasts, in the bays and streams, and is everywhere considered a nuisance. It spawns in summer. Its eggs are as large as cherries, and are incubated in the mouth and throat of the male. Specimens from Tampa.

10. **Ælurichthys marinus** (Mitchill). *Catfish.* Not nearly so common as the preceding species, being more of a deep-water fish. Specimens from Key West. The sea-catfishes are not used for food in Florida, being universally despised and detested where so many better fishes abound.

ALBULIDÆ.

11. **Albula vulpes** (Linn.). *Bonefish.* Common along the southern keys, and at the passes and inlets of the coasts. It is a graceful, silvery fish, shuttle-shaped, and quite a good food-fish, though bony. It is, moreover, a good game-fish, readily taking the fly or bait, and gives the angler more sport, for its size, than any of the marine fishes. It grows to 2 feet in length. Specimens from Key West and Tampa.

ELOPIDÆ.

12. **Elops saurus** Linn. *Ten-pounder.* Not quite so common as the bonefish, which it resembles in general conformation, color, and size. It is of no economic importance. Examples obtained at Key West and Tampa.

13. **Megalops thrissoides** (Bloch & Schneider). *Tarpon.* Common on both coasts, in the bays and lagoons, especially in summer, the smaller ones, of from 5 to 40 pounds, ascending the streams. It is a noble, handsome fish with very large scales, resembling frosted silver, which, on account of their size and brilliancy, are preserved as curiosities. It grows to an immense size—some 200 pounds. It is not a food-fish, its flesh being coarse and stringy and of the color of veal. It breeds in Cuba, and is supposed to breed in Florida, but in all of my collecting, with fine-meshed seines, I have never seen one less than a foot in length. It is very fond of the sun-light, and will lie under the mangroves for hours, perfectly motionless, basking in the sun. At other times they disport themselves on the surface of deeper water, in schools, like porpoises. It is universally called "tar-pon′," in both singular and plural, by the native fishermen.

The tarpon, owing to its great size and its habit of continually leaping from the water when hooked, has become a noted game-fish, and is much sought after by Northern anglers, who congregate mostly about the lower part of Charlotte Harbor, near Punta Rassa, and at Fort Myers, 20 miles above, on the Caloosahatchee River. The largest examples so far taken on the rod of the angler weighed, respectively, 196 and 205 pounds, the latter being taken by Mrs. George T. Stagg, of Kentucky, the former by Mr. McGregor, of New York. The skins of these two fine specimens, having been prepared and mounted, were exhibited at the World's Columbian Exposition, where they commanded the wonder and admiration of all, especially of the foreign visitors. The tarpon is taken by the natives of Florida by means of the fish spear or "grains" (in the use of which they are very expert) when it is basking in the sun in shallow water. I obtained a very fine specimen, 6¼ feet long and weighing 125 pounds, in Sarasota Bay, though at the time of my visit the water was unusually cold and tarpon consequently very scarce.

CLUPEIDÆ.

14. **Alosa sapidissima** (Wilson). *Shad.* I saw this fine food-fish in January at Jacksonville and St. Augustine, it having been taken in the St. Johns River. They were mostly of small size.

15. **Brevoortia tyrannus** (Latrobe). *Herring.* I obtained a number of examples of the menhaden at Tampa (where it is called "herring"), which I believe is the first instance of its being collected on the Gulf coast by any naturalist. It is, however, known from the mouth of the St. Johns River on the Atlantic coast. The southern form, *B. patronus* Goode, is common in the Gulf.

SYNODONTIDÆ.

16. **Synodus fœtens** (Linn.). *Lizard-fish.* Common on both coasts and along the keys in sandy situations. Grows to a foot or more in length. Not used as food. I obtained specimens at Key West and Tampa.

MURÆNIDÆ.

17. **Gymnothorax funebris** Ranzani. *Green Moray.* Not uncommon about the Florida keys. It grows to 6 or 8 feet in length, is very strong and vigorous, and as active and slippery as an eel. It is much dreaded by the fishermen when caught on their lines, being very ferocious and combative. It has been known to drive a man overboard to escape its terrible teeth, its bite being believed to be poisonous. It is never eaten. Its beautiful bright green coloration resides in the slime with which it is covered, and which disappears when this is removed, leaving the skin of a muddy, brownish-black color. I obtained three specimens at Key West, each some 5 feet in length, one of which was caught with hook and line from the wharf.

18. **Gymnothorax moringa** (Cuvier). *Speckled Moray.* Rather common along the Florida keys. Does not grow so large as the green moray, and is not held in such common detestation, perhaps owing to its beautiful coloration, which, while varying somewhat in different specimens, is always pretty in the variegated spots, reticulations, and markings. I obtained several examples at Key West, from 2 to 3 feet in length.

SCOMBERESOCIDÆ.

19. **Tylosurus raphidoma** (Ranzani). *Hound.* Common along the keys and reefs. Grows to a length of 3 or 4 feet. It obtains the name of "hound" from its habit of running in schools and leaping along the surface of the water. It is larger than the other species of the genus, and, like the others, is a fair food-fish, though seldom utilized in Florida. Specimens from Key West.

20. **Tylosurus notatus** (Poey). *Needle-fish.* Very common along the coasts and keys in schools. Grows to 2 feet in length. Specimens from Key West and Tampa.

21. **Hemirhamphus balao** Le Sueur. *Ballyhoo.* Abundant about Key West and along the coasts, running in schools. It reaches a length of 15 to 18 inches, and is a fair food-fish, though no use is made of it in Florida. The other species of "half-beaks" are also abundant, and all are called "ballyhoo" by the fishermen. Specimens from Key West.

SYNGNATHIDÆ.

22. **Hippocampus hudsonius** De Kay. *Sea Horse.* Common in the shallow bays of the west coast in grassy situations. Grows to a length of 6 or 7 inches. I procured several large examples at Tampa. Rings, 11 + 32. Dorsal fin with 18 rays, covering 3½ rings.

MUGILIDÆ.

23. **Mugil cephalus** Linnæus. *Mullet.* Very abundant on all shores of Florida. I obtained some fine large specimens at Tampa, whence large quantities are shipped on ice during the winter, principally to the Southern States. In Florida it is esteemed very highly in the autumn, when in roe, and all things considered is the most important food-fish of the State. At the fishing ranches of the west coast it is cured and salted in the fall and early winter, and shipped to Key West and Cuba. It reaches a weight of several pounds, and spawns principally in November. I have often watched them coming in the passes and inlets on the flood tide, feeding along the shore like droves of hogs. Their manner of feeding is peculiar. They move slowly along, never stopping, taking a mouthful of sand from the sharply cut banks of the inlets, and blowing it out again, retaining the minute organisms contained therein. They also feed about the sand banks and mud flats of the bays and streams.

24. **Mugil curema** Cuvier & Valenciennes. *Silver Mullet.* Not nearly so common as the preceding species, and frequents deeper water. It spawns somewhat later in the season than the common mullet, and is its equal if not its superior as a food-fish. Specimens from Tampa.

25. **Mugil trichodon** Poey. *Fantail Mullet.* Common about Key West, being more of a salt-water than a brackish-water species. It is smaller than either of the preceding species, reaching a length of about 12 inches, but is more robust, and with a broader, fan-like caudal fin. Also a good food-fish. Examples from Key West.

SPHYRÆNIDÆ.

26. **Sphyræna guaguanche** Cuvier & Valenciennes. *Sennet.* Not common, and is found in deeper water than the *S. picuda,* and is a much smaller species. The coloration is also quite different, having dark blotches or patches along the lateral line. Examples from Key West.

27. **Sphyræna picuda** Bloch & Schneider. *Barracuda.* Abundant along the keys. It reaches a length of 6 or 7 feet, and is a very fierce, voracious fish, of pike-like habits. It is esteemed as a good food-fish at Key West. It is usually "grained" in the shallow bays by the fishermen. I have seen them fully 6 feet in length in such situations. Several specimens from Key West.

ECHENEIDIDÆ.

28. **Echeneis naucrates** Linnæus. *Suckfish.* Common everywhere in Florida. Nearly every shark or ray when caught has from one to a half dozen attached. The host suffers no inconvenience whatever from this curious fish, which finds abundant food in the crumbs from the shark's table, whether from fragments cut off by the shark's teeth while feeding or when ejected from an overcharged stomach. It often attaches itself to the bottom of vessels, when it is easily caught with hook and line, it being very voracious. It has no more especial fondness or affinity for sharks or other large fishes than for the keel of a boat; it is merely a matter of convenience. I know nothing of its qualities as a food-fish. Specimens were procured at Key West.

ELACATIDÆ.

29. **Elacate canada** (Linn.). *Cobia.* Not common about the keys or on the west coast. It is a very fierce and rapacious fish. It is not used for food in Florida. I obtained a fine example at Key West about 5 feet long. It is called "cobi-o'" by the fishermen.

XIPHIIDÆ.

30. **Istiophorus americanus** Cuvier & Valenciennes. *Spikefish.* Rare. I obtained a fine specimen at Key West about 8 feet in length. The immense dorsal fin folds like a fan and is received in a groove along the dorsum. Coloration was bluish brown, with very dark round spots on dorsal fin. The fishermen call it "pikefish" and "spikefish," from the resemblance of the "sword" to a pike. They also affirm the prevalent idea, that the dorsal fin is used as a sail.

SCOMBRIDÆ.

31. **Scomberomorus maculatus** (Mitchill). *Spanish Mackerel.* Abundant in the spring along the keys and coast, swimming in schools at the surface. In the bays it is usually accompanied by schools of sea trout (*Cynoscion nebulosus*), feeding on the small fry of pilchards, anchovies, silversides, etc. It spawns in the spring. It is one of the best food-fishes, and many from Florida now find their way to the New York markets. I saw a Cape Ann schooner engaged in taking Spanish mackerel with seine boat and mackerel purse seine. It is one of the most graceful and typical fishes, and withal is a good game-fish, taking the fly or bait at the surface very readily and greedily, and when hooked gives considerable sport to the angler. It grows to a length of 2 feet. Specimens were obtained at Key West and Tampa.

32. **Scomberomorus cavalla** (Cuvier). *Kingfish.* Common along the keys and reefs, where it is taken by the fishermen by trolling from the fishing smacks under sail. It is esteemed as the best food-fish taken to Key West. It runs usually from 8 to 10 pounds, but occasionally reaches 40 pounds in weight and 5 feet in length. The entire catch is consumed at Key West, except a few that are shipped on ice to Havana. A few are now finding their way to eastern markets, where the fish will in time become deservedly popular. I obtained specimens at Key West, where it was brought in such quantities at one time that a 10-pound fish sold for 15 cents.

33. **Scomberomorus regalis** (Bloch). *Spotted Kingfish; Cero.* Not common. Occasionally brought in by the smacks with the *S. cavalla*, and is more frequently called "kingfish" than "cero." It grows to nearly the same size, and is equally valued as a food-fish. I obtained two specimens at Key West, and saw but few more out of hundreds of the common kingfish (*S. cavalla*).

34. **Sarda sarda** (Bloch). *Bonito.* Not uncommon along the keys and reefs. Sometimes taken by the kingfishermen on their trolling lines. Is is a fair food-fish, but is not much esteemed at Key West, the meat being dark and with a pungent flavor. It grows to 15 or 20 pounds occasionally. It is readily known by the oblique stripes along the sides. Specimens from Key West.

35. **Euthynnus alliteratus** (Rafinesque). *Ocean Bonito.* Not common. Is taken on the trolling lines of the kingfishermen occasionally. It is not favorably considered as a food-fish and is seldom brought to market. It is easily distinguished from the preceding "bonito," by its stripes being horizontal or longitudinal. It is one of the large species of fishes, reaching 30 to 50 pounds occasionally. Example from Key West.

CARANGIDÆ.

36. **Caranx bartholomæi** Cuvier & Valenciennes. *Yellow Jack.* Not common. Occasionally taken by the fishermen of Key West. Color olivaceous with golden or bronze reflections and yellow fins, hence "yellow jack." It is one of the prettiest "jacks," though of small size. Probably a fair pan-fish. Specimens obtained at Key West.

37. **Caranx chrysos** (Mitchill). *Runner.* Common along the keys. Taken with hook and line by boys from the wharves of Key West frequently. It is the best of the "jacks" as a food-fish, as it is the most graceful in shape and appearance. It is also the most "silvery" of the jacks, the others having a more or less golden or bronze sheen. It is much esteemed at Key West. Examples from Key West.

38. **Caranx latus** Agassiz. *Horse-eye Jack.* Common. Often taken from the wharves of Key West by boys. Grows to about a foot in length. Not much considered as a food-fish. Called "horse-eye," owing to its peculiarly large, adipose eyelid. Examples from Key West.

39. **Caranx hippos** (Linn.). *Jack; Cavalla.* Common in the channels about the keys and at the inlets and passes of both coasts. It is the "jack" *par excellence.* It grows to a large size, reaching sometimes 25 or 30 pounds and 3 or 4 feet in length. It is a tolerably fair food-fish, not thought much of in Florida, but is shipped to some extent from Tampa with mullet, redfish, sea trout, etc. It is a fine game-fish, being strong and vigorous on the hook, and takes the fly or a troll, or even a bit of white rag, quite readily. Examples from Tampa and Key West.

40. **Caranx crinitus** (Mitchill). *Sunfish.* Not very common. It is usually found in deep water, where it floats on its side at the surface, basking in the sunshine, from which habit it derives the name of "sunfish." I know nothing of its food qualities. Coloration brilliantly silvery. Examples from Key West.

41. **Selene vomer** (Linn.). *Moonfish.* Not uncommon. This well-known and curious species is said to be a good food-fish, but there is very little of it, being so thin or compressed. It is pressed, dried, and preserved as a curio. Grows to a foot in length occasionally. Adult specimens were obtained at Key West and Tampa.

42. **Trachinotus carolinus** (Linn.). *Pompano.* Common along the keys and inlets of both coasts. The most esteemed of all the food-fishes of Florida, and is, undoubtedly, the best that swims. It finds a ready sale at good prices, most of the catch in the winter, however, being consumed at the hotels of Florida. It grows to a pound or two in weight, and is mostly taken by haul seines on the outside beaches of the keys of the west coast at flood tide, where it is found feeding on beach fleas and the little "pompano-shell" mollusks. Specimens obtained at Tampa and Key West.

43. **Trachinotus rhodopus** Gill. *Permit.* Not uncommon along the keys and the west coast. This is the largest of our pompanos. It is not esteemed as a food-fish, though the smaller ones sometimes have the dark borders of the dorsal and caudal fins clipped by unscrupulous dealers and are sold with the "pompano" as the simon-pure, original Jacobs. The "permit" grows to a large size, 25 or 30 pounds. Examples were obtained at Tampa and Key West.

44. **Trachinotus glaucus** (Bloch). *Old Wife.* Not very common. Found about the Florida Keys. The "Old Wife" ranks with the "permit" as a food-fish, though it is of small size, the smallest of the pompanos. It is a pretty fish, silvery, with several vertical dark bars on its sides, being the only pompano with distinct markings. Examples from Key West.

45. **Seriola dumerili** (Risso). *Almicore.* Not common. Occasionally taken by fishermen when trolling for kingfish along the Florida keys. Said to be a fair food-fish, but not utilized at Key West. Grows to 50 pounds or more. One specimen from Key West.

46. **Seriola lalandi** Cuvier & Valenciennes. *Amber Jack.* Not common along the keys and reefs, where it is taken by kingfishermen, trolling. It is a tolerably fair food-fish and grows very large, 75 pounds or more. Examples secured at Key West.

47. **Oligoplites saurus** (Bloch & Schneider). *Leather Jack.* Common at Key West, where it is caught from the wharves by boys with hook and line. The smallest of the "jacks." It is a pretty, graceful, and lively fish, but of no importance economically. The name "leather jacket" has somehow crept into the books as the name of this fish, but it is never called so in Florida; that name is sometimes applied to species of *Balistidæ*, but *O. saurus* is always "leather jack." Specimens from Key West.

POMATOMIDÆ.

48. **Pomatomus saltatrix** (Linn.). *Bluefish.* Not common on the west coast, but rather common on the east coast of Florida. It is shipped to a limited extent from Tampa during the winter, and finds a ready sale, as it is considered a fine food-fish. It is of finer flavor in Florida than in northern waters. Specimens from Tampa.

CORYPHÆNIDÆ.

49. **Coryphæna hippurus** Linn. *Dolphin.* Not uncommon along the reefs of Florida. I secured several fine examples at Key West, but at a time when the supply of ice was exhausted for a few days, in consequence of which they reached Washington too soft for molding.

HOLOCENTRIDÆ.

50. **Holocentrus ascensionis** (Osbeck). *Squirrel-fish.* Not common. Occasionally taken along the keys. It is a good food-fish, but not plentiful enough to be of any importance. It is a very handsome fish, being bright crimson, with brilliant silver stripes along the sides. Several examples obtained at Key West.

CENTROPOMIDÆ.

51. **Centropomus undecimalis** (Bloch). *Snook; Rovallia.* Common in bays and estuaries of both coasts and ascending streams. A voracious fish, growing to a weight of 25 or 30 pounds. A fairly good table fish, but is not held in much esteem in Florida. Unless skinned, it is apt to have a soapy or slimy taste. It is a good game-fish, readily taking a gaudy fly, troll, or natural bait, and is a vigorous fighter when hooked. Coloration bright silvery, greenish on dorsum, with a broad black stripe along the lateral line. Examples from Tampa.

SERRANIDÆ.

52. **Centropristis striatus** (Linn.). *Blackfish.* Rare on the west coast, but not uncommon on the east coast of Florida. I secured two specimens at Tampa, where it is occasionally brought by the fishermen.

53. **Diplectrum formosum** (Linn.). *Sandfish.* Common about the southern keys. A pretty little pan-fish of good quality, but too small to be sought after. Examples from Key West.

54. **Promicrops guttatus** (Linn.). *Spotted Jewfish.* Common along the Florida keys. Grows to an enormous size, reaching, it is said, 500 pounds. An excellent food-fish, and one much esteemed at Key West, where it is sold in steaks, which are fried in batter. Usually brought to market weighing from 20 to 150 pounds. I had not seen this "jewfish" before, my former experience being confined to the black jewfish (*E. nigritus*). At Key West I saw some twenty examples, ranging from 20 to 200 pounds, and shipped two to Washington of 60 and 100 pounds, respectively.

55. **Mycteroperca falcata** (Poey). *Scamp.* Common along the Florida keys, and considered a good food-fish. It is taken by trolling along the keys and by bait fishing on the snapper banks. It averages about 6 pounds, often reaching 10. Specimens from Key West.

56. **Mycteroperca microlepis** (Goode & Bean). *Gag.* Common along the Florida keys and not uncommon on west coast. Taken by trolling, also by bait fishing on the "banks." It is a fair food-fish, averaging 6 or 8 pounds, sometimes reaching 25 or 30. The "gag" and "scamp," and all of the "groupers" are skinned usually when dressed for cooking; not skinned like an eel or catfish, but "pared," like a potato, with a very sharp knife. Examples from Key West.

57. **Mycteroperca bonaci** (Poey). *Black Grouper.* Common along the Florida keys and rocky places on the coast. Taken by trolling or still fishing. A fair food-fish, averaging 12 or 15 pounds, but reaching a weight of 40. It is a gamy, hard-pulling fish on the hook, and is a favorite with the "still-fishing" angler. The "groupers" all spawn in spring. I obtained specimens at Key West.

58. **Mycteroperca venenosa** (Linn.). *Rockfish.* The var. *venenosa* is not uncommon about the southern keys. It averages 5 to 7 pounds, reaching 12 pounds occasionally. Said to be a fair food-fish, and is certainly a handsome one, its colors being quite variegated.

59. **Epinephelus morio** (Cuvier & Valenciennes). *Red Grouper.* Very common about Key West and on the banks. One of the principal food-fishes. Taken by trolling or still fishing. A gamy, vigorous fish, averaging 6 or 8 pounds, but grows to 20 or more. Specimens from Key West.

60. **Epinephelus striatus** (Bloch). *Nassau Grouper.* Not uncommon about the southern keys, and is considered an excellent food-fish. It averages 18 to 24 inches in length and 6 or 8 pounds in weight, sometimes reaching 20 pounds. It is a handsomely marked fish, and finds a very ready sale in the market. Example from Key West.

61. **Epinephelus catus** (Cuvier & Valenciennes). *Red Hind.* Not uncommon at Key West. A very handsome species, of beautiful coloration, and said to be a good food-fish, though small, seldom reaching a foot in length or much more than a pound in weight. Taken by still fishing in the channels. Examples from Key West.

62. **Epinephelus adscensionis** (Osbeck). *Rock Hind.* Not uncommon about Key West. Is much esteemed as a food-fish, though not at all plentiful. It is a beautiful fish, profusely covered with large red spots. It averages a pound or two in weight, and is taken in the channels by still fishing. Specimens from Key West.

63. **Epinephelus flavolimbatus** Poey. *Yellow-finned Grouper.* Not common. One specimen from Key West. A fair food-fish, averaging 6 pounds, but said to reach 15 pounds in weight. The coloration is very gay.

64. **Bodianus cruentatus** (Lacépède). *Coney.* Not uncommon about the southern keys and reefs. A small but beautiful species, and much esteemed as a food-fish. It rarely exceeds a pound in weight or 10 inches in length. Loves rocky situations, like the "Coney" of Holy Writ, where it is taken by still fishing.

65. **Bodianus fulvus** (Linn.). *Nigger-fish.* Not uncommon at Key West. A very gaily-colored pan-fish, though not very plentiful. There seem to be several varieties, of which the brown (*punctatus*) is the commonest, and of which examples were obtained at Key West.

66. **Rypticus bistripinnis** (Mitchill). *Soapfish.* Not common. I caught one small example with hook and line from the steamer wharf, which answered fairly well to the description of this species. The coloration was chestnut-brown, with whitish stellate spots. Fins all a beautiful, intense ultramarine blue. Specimen 6 inches long.

PRIACANTHIDÆ.

67. **Priacanthus catalufa** Poey. *Glass-eye Snapper.* Not common. I obtained but one specimen of this beautiful species at Key West, where it is not often seen. I know nothing of its food qualities. Coloration brilliantly scarlet. Eye very large, half as long as head.

LOBOTIDÆ.

68. **Lobotes surinamensis** (Bloch). *Black Snapper.* Not common. I secured a large specimen at Tampa, where it is known as "black snapper."

SPARIDÆ.

69. **Lutjanus caxis** (Bloch & Schneider). *Schoolmaster.* Not uncommon at Key West. A fair food-fish, growing to about a foot in length and a pound or two in weight. Examples from Key West.

70. Lutjanus jocu (Bloch & Schneider). *Dog Snapper.* Not uncommon at Key West, where I obtained specimens. A pretty fair food-fish, growing somewhat larger than the preceding species. Both are handsome fishes.

71. Lutjanus griseus (Linn.). *Gray Snapper.* Abundant along Florida keys and islands on both coasts, especially where the mangrove abounds, and on this account often called "mangrove snapper." It is a fair food-fish, rarely exceeding a foot in length or 2 pounds in weight. It is a fine game-fish with light tackle, rising well to the artificial fly and taking bait readily. It is, however, very shy, and must be fished for cautiously and warily.

72. Lutjanus synagris (Linn.). *Lane Snapper.* Abundant at Key West, and one of the common pan-fishes sold in market. It is much esteemed. Does not often exceed 6 inches in length and seldom reaches a pound in weight. A beautiful little fish, the smallest of the "snappers."

73. Lutjanus blackfordii Goode & Bean. *Red Snapper.* Abundant on the "banks." This well-known dinner fish is now shipped all over the country in the winter and spring from Tampa and Pensacola. It reaches 20 pounds in weight and is a fairly good food-fish, bearing transportation well, being hard and firm of flesh. Examples from Tampa.

74. Lutjanus analis (Cuvier & Valenciennes). *Mutton-fish.* Abundant at Key West. A food-fish of good size and fair quality, and sells well in the market. It reaches a length of 2 feet or more and averages 6 or 8 pounds, though sometimes weighing 20. Fine examples from Key West.

75. Ocyurus chrysurus (Bloch). *Yellow-tail.* Abundant along southern keys. A very common and esteemed pan-fish at Key West. A very pretty and well-marked species; seldom grows to exceed a foot in length or a pound in weight. Examples from Key West.

76. Orthopristis chrysopterus (Linn.). *Pig-fish.* Very common on west coast and not uncommon at Key West. A good pan-fish, though not utilized owing to its small size, its average length being 6 inches. Specimens from Key West.

77. Anisotremus virginicus (Linn.). *Pork-fish.* Common at Key West. A handsome and beautifully marked species and a good pan-fish, sometimes reaching a pound or two in weight, though usually of about half a pound. Examples from Key West.

78. Hæmulon rimator Jordan & Swain. *Tom Tate.* Common at Key West, though not much esteemed, being the smallest of the "grunts," rarely reaching a half-pound in weight, but a pretty little fish. Examples from Key West.

79. Hæmulon flavolineatum (Desmarest). *French Grunt.* One of the smaller "grunts," but not common at Key West, where it is occasionally sold with the commoner forms. Specimen from Key West.

80. Hæmulon plumieri (Lacépède). *Grunt.* Very abundant at Key West, where it is the favorite and staple breakfast fish, being sold in bunches of half a dozen for from 5 to 10 cents a bunch. It is related of an old and wealthy citizen of Key West that while sojourning for a time at a fashionable New York hotel, and where he was living on the fat of the land, that his constant and only regret was that he could not procure "fried grunts" for his breakfast. Indeed, many of the inhabitants of Key West live almost exclusively upon "grunts," seldom eating meat of any kind, except when occasionally they indulge in turtle-steak. The common grunt seldom exceeds a pound in weight, usually being of half that size, or even less, as found in the market. It is sometimes called "sow grunt," the *H. sciurus* being thought by some to be the male and called "boar grunt." The "grunt" is also found at rocky places on the west coast, though not in abundance. Examples from Key West.

81. Hæmulon sciurus (Shaw). *Yellow Grunt.* Common at Key West, though much less so than the *H. plumieri*, with which it is sold in the market. It is the handsomest of the "grunts," the sides of the body as well as the head being ornamented with beautiful blue and old-gold stripes. It is equally esteemed as a pan-fish with the common grunt, and rarely exceeds a length of 12 inches or a weight of 1 pound, the average being 6 inches and 4 ounces. I believe I was the first to collect this species in Florida, in 1878. Examples from Key West.

82. Hæmulon parra (Desmarest). *Sailor's Choice.* This is another of the smaller "grunts," and sometimes sold with them, though it is not at all common in the market, probably owing to its small size. It is a good pan-fish, however. Examples from Key West.

83. Hæmulon album (Cuvier & Valenciennes). *Margate Fish.* Common at Key West. The largest of the "grunts," growing to 2 feet or more and to 8 or 10 pounds. It is an esteemed food-fish. Examples from Key West.

84. **Calamus proridens** Jordan & Gilbert. *Little-head Porgy.* This and the following "porgies" are fair food-fishes, and are sold in large quantities as pan-fish at Key West, and are quite common along the southern keys. This is one of the prettiest porgies, being silvery with beautiful, iridescent tints; it is also one of the smallest, seldom exceeding 6 to 8 inches in length. It is called "little-head" in contradistinction to the "big-head" or "jolt-head" porgy. Examples from Key West.

85. **Calamus calamus** (Cuvier & Valenciennes). *Saucer-eye Porgy.* Not so common as the other porgies, and seldom grows beyond a pound in weight or 12 inches in length. It has a large, round eye, hence "saucer-eye." Specimens from Key West.

86. **Calamus bajonado** (Bloch & Schneider). *Jolt-head Porgy.* Very common at Key West. The most important of the porgies, growing to a larger size, almost 2 feet occasionally, and to 6 or 8 pounds in weight. A fair food-fish, selling largely in the market. Examples from Key West.

87. **Calamus penna** (Cuvier & Valenciennes). *Sheepshead Porgy.* Not uncommon at Key West. It ranks with the other porgies as a pan-fish. It grows to nearly a foot in length and to more than a pound in weight. It resembles somewhat the common "sheepshead" (*Archosargus probatocephalus*) in its barred sides, also in the conformation of its body. Specimens from Key West.

88. **Calamus arctifrons** Goode & Bean. *Grass Porgy.* Not uncommon at Key West. It is the most distinctly marked and the handsomest of the porgies. It is not so common as the others, and grows to about the same size as the "saucer-eye" and "little-head" porgies. Examples obtained at Key West.

89. **Lagodon rhomboides** (Linn.). *Brim.* Abundant on both coasts and common at Key West. A graceful, pretty fish; a fair food-fish, though not much utilized, owing to its small size. Average size, 6 inches. Examples from Tampa.

90. **Archosargus probatocephalus** (Walbaum). *Sheepshead.* Very abundant in bays and lagoons of both coasts, and ascending streams to fresh water, even to the springs at the fountain head. It swarms about barnacle-covered piles, wharves, wrecks, oyster banks, mangroves, etc., on the mainland, but is not often seen near the southern keys. It is the most abundant food-fish on the west coast, with the exception of the mullet. It is not nearly so much esteemed as a food-fish in Florida as at the North, nor is it of so good a flavor as at the North, nor does it grow so large, about 6 pounds being its maximum weight in Florida. It is largely cured at the fishing ranches, with the mullet, and is shipped on ice from Tampa with mullet, redfish, etc. It is a fair game-fish, biting freely at clam or crab bait, and is quite vigorous on the hook, but, like all bottom fish, never rises to the surface.

91. **Diplodus holbrooki** (Bean). Not uncommon at Tampa, but of small size and seldom used for food. Average length, 6 inches. Examples from Tampa.

92. **Kyphosus sectatrix** (Linn.). *Chub.* Common at various locations on the west coast. Rather a deep-water fish. At Mullet Key, at lower end of Tampa Bay, I caught 10 chub in 10 minutes with fiddler-crab bait, in water 20 feet deep, alongside of the piles of the quarantine station, where it was feeding on the barnacles. It is an excellent pan-fish, averaging 6 to 8 inches in length.

SCIÆNIDÆ.

93. **Pogonias cromis** (Linn.). *Drum.* Common in bays of both coasts, especially about oyster reefs and mangrove islands, but does not frequent the southern keys. It is not much esteemed as a food-fish, though it is shipped to some extent from Tampa during the winter. It grows to a large size, 40 or 50 pounds occasionally. It is a vigorous, hard-pulling fish on the hook, but not very "gamy." Its "drumming" is constantly heard near the oyster beds. Examples from Tampa.

94. **Sciæna ocellata** (Linn.). *Bass; Redfish.* Abundant in bays of both coasts in both salt and brackish water, and often ascending streams. It is a good fish and is shipped in large quantities, on ice, from Tampa. It grows to a large size, 50 or 60 pounds occasionally. It is a free-biting, vigorous game-fish, taking live or cut bait, and small ones rise pretty well to the fly. It gives considerable sport when hooked. It is, all things considered, the best food and game fish of the drum family. Fine specimens were obtained at Tampa.

95. **Leiostomus xanthurus** Lacépède. *Spot.* Common in bays of both coasts. It is a good pan-fish and takes a bait readily. It averages 6 to 8 inches in length. Specimens were obtained at Tampa.

96. Micropogon undulatus (Linn.) *Croaker.* Very common in bays of the west coast. A fair pan-fish when just out of the water, but not much utilized. Average length 8 inches. Examples from Tampa.

97. Menticirrus saxatilis (Bloch & Schneider). *Whiting.* Not common on the west coast. Occasionally brought to market by the fishermen of Tampa. It is a fair food-fish if just out of the water, but deteriorates rapidly. Grows to about a length of 18 inches and a pound or two in weight. A few examples were procured at Tampa.

98. Cynoscion nothum (Holbrook). *Summer trout.* Not very common. Brought to Tampa occasionally by the fishermen, who call it "summer trout," it being more common in the summer season; it resorts to deeper water than the regular "trout" (*C. nebulosus*), but grows to about the same size and is equally esteemed as a food-fish. It spawns a little later, also, than the next species. Examples from Tampa.

99. Cynoscion nebulosus (Cuvier & Valenciennes). *Trout.* Abundant in bays of the west coast and common on the east coast. An important food-fish of good quality when fresh, and shipped in large quantities, on ice, from Tampa in the winter and spring. When long out of water it becomes soft and loses its flavor. It grows to a length of 2 or 3 feet. It is a fine game-fish, being a surface feeder, and rises readily to the artificial fly. It spawns in the spring. Fine specimens were obtained at Tampa.

GERRIDÆ.

100. Gerres cinereus (Walbaum). *Broad Shad.* Not uncommon at Key West, but more abundant on the coasts of the mainland. It is utilized to some extent as a food-fish at Key West. Grows to 15 or 18 inches in length. Examples obtained at Key West.

101. Gerres gula Cuvier & Valenciennes. *Shad.* Common at Key West and at inlets of the coast. It is not used for food, averaging only about 6 inches in length. Examples from Key West.

LABRIDÆ.

102. Lachnolaimus maximus (Walbaum). *Hogfish.* Common at Key West, where it is considered a good food-fish. It reaches a weight, sometimes, of 8 or 10 pounds, though usually from 2 to 6. The male and female vary considerably in coloration. It is a fish of singular and characteristic appearance. Male and female examples obtained at Key West.

103. Halichœres radiatus (Linn.). *Pudding Wife.* Not uncommon along the southern keys. It is sometimes eaten at Key West, but it is not generally esteemed as a food-fish. It is interesting chiefly on account of its gay coloration, in which blue and bright green predominate. It grows to nearly 2 feet in length. Examples from Key West.

104. Sparisoma flavescens (Bloch & Schneider). *Pug.* Not uncommon about Key West. Like most of the "parrot" fishes it is not used for food, and like them is admired only for its bright coloration. It sometimes reaches a foot in length. Examples obtained at Key West.

105. Scarus cœruleus Bloch & Schneider. *Blue Pug.* Not uncommon at Key West, where specimens were secured.

106. Scarus guacamaia Cuvier. *Parrot-fish.* Rather common at Key West. This is the largest of the parrot-fishes, growing to a length of 2 feet. Specimens from Key West.

EPHIPPIDÆ.

107. Chætodipterus faber (Broussonet). *Angel-fish.* Abundant on the west coast. It is a most excellent food-fish, though not generally appreciated. It is shipped from Tampa in large quantities with sheepshead, etc. It is usually 8 or 10 inches long, sometimes reaching a foot in length. Examples from Tampa.

CHÆTODONTIDÆ.

108. Holacanthus ciliaris (Linn.). *Yellow Angel.* Not uncommon along the southern keys and reefs. A good food-fish, but not common enough to be of economic importance. A beautiful, gaily-colored fish. Grows to a foot in length. Fine specimens obtained at Key West.

109. **Pomacanthus aureus** (Bloch). *Black Angel.* Rather common along the reefs and keys. Also a good food-fish, but not plentiful enough to be utilized. A handsome, showy fish, growing to a foot in length and nearly as deep. Examples from Key West.

ACANTHURIDÆ.

110. **Acanthurus hepatus** (Linn.). *Tang.* Not uncommon about the southern line of keys and the outer reefs. Called "tang" because of the lancet-shaped spine or tang on each side of the tail, and which gives this fish the name of "surgeon" and "doctor" in other localities. Examples obtained at Key West.

111. **Acanthurus cœruleus** Bloch. *Blue Tang.* Found in the same situations as the preceding species—the common tang. A much prettier fish than the last, the coloration being very bright and varied. Both species grow to 18 inches in length. Used somewhat as food-fishes. From Key West.

SCORPÆNIDÆ.

112. **Scorpæna plumieri** Bloch. *Sea Toad.* Not uncommon about the southern keys. One of the most bizarre fishes of the Florida fauna. To the fishermen it is rather repulsive, as it is thought to be poisonous. But it is very beautiful, if a brilliant and highly-varied coloration and ornamental appendages of fringes, tabs, and streamers can make it so. Grows to a foot in length. Not used for food. Several specimens were obtained at Key West.

113. **Scorpæna grandicornis** Cuvier & Valenciennes. *Sea Toad.* Found in same localities with *S. plumieri*, but less common. It is not as gorgeously colored as that species, but grows to about the same size and is held by the fishermen in as much disfavor. Example from Key West.

TRIGLIDÆ.

114. **Prionotus tribulus** Cuvier & Valenciennes. *Sea Robin.* Not uncommon about the coasts. It is not used for food. One specimen from Tampa.

BATRACHIDÆ.

115. **Batrachus tau** (Linn.). *Toadfish; Oyster-fish.* Common in the bays of both coasts, especially about oyster beds. Supposed to be poisonous by the fishermen and of course detested. Grows to a foot in length. Examples from Tampa.

116. **Batrachus pardus** Goode & Bean. *Toadfish.* Found with preceding species, *B. tau;* but not so common. Equally abhorred by fishermen. From Tampa.

PLEURONECTIDÆ.

117. **Syacium micrurum** Ranzani. *Window Pane.* Not uncommon at Key West. A small species, averaging about 6 inches. Color olivaceous, with body and fins profusely spotted. The flat-fishes are not valued as food-fishes at Key West, where I obtained examples.

118. **Paralichthys lethostigma** Jordan & Gilbert. *Flounder.* Common in bays of west coast. Not valued as a food-fish in Florida. Grows to 18 inches in length. Examples from Tampa.

119. **Ancylopsetta quadrocellata** Gill. *Spotted Flounder.* Common in bays and lagoons of west coast. A fair food-fish, but not utilized as such in Florida. The largest seen were a foot in length. Specimens from Tampa.

MALTHIDÆ.

120. **Malthe vespertilio** (Linn.). *Batfish.* Not common at Key West, but common in bays of both coasts. Grows to a length of 6 inches. Not used for food, being very repulsive in appearance to most people. Specimens from Tampa.

121. **Malthe radiata** (Mitchill). *Batfish.* Common in bays and lagoons of both coasts. Grows to 6 inches in length. Is very similar to *M. vespertilio*, but with much shorter rostral process, and the red color of belly is constantly of a lighter shade. Examples from Tampa.

OSTRACIIDÆ.

122. Ostracion trigonum Linn. *Shellfish.* Not uncommon on shores of keys in grassy situations. It is said to be an excellent food-fish when roasted or baked "in the shell." It is dried and preserved as a curiosity. The coloration of all the cowfishes is very pretty. Specimens from Key West.

123. Ostracion tricorne Linn. *Cowfish.* Common in grassy bights of the keys, and in the coves of all bays on the mainland. The cowfishes grow to about 10 inches in length. They are very sensitive to cold; after the unusually cold snap in Florida, in January, 1886, I saw hundreds of dead and dried cowfish washed up on the beaches. Examples from Tampa.

BALISTIDÆ.

124. Balistes vetula Linn. *Ocean Turbot.* Not common. Found occasionally along the reefs and southern keys. It is the handsomest of the "trigger-fishes." Grows to a larger size, also, some 2 feet in length. I know nothing of its food qualities. Several specimens from Key West.

125. Balistes carolinensis Gmelin. *Turbot.* Common at Key West and vicinity. It is considered a good food-fish and sells readily in the market. It is always skinned, or rather "pared," before cooking. It averages about 12 inches in length. It is called "turbot" by all Key West people. Examples from Key West.

126. Monacanthus ciliatus (Mitchill). *Leather-fish.* Common at Key West and vicinity. Not used for food. The male has stiff bristles or spines in the tail. Less than a foot in length. Specimens obtained at Key West.

127. Monacanthus hispidus (Linn.). Also common at Key West and vicinity. Grows to 8 or 10 inches in length. Not used for food. Examples from Key West.

128. Alutera schœpfi (Walbaum). *Long-tail Leather-fish.* Not uncommon along the keys and at rocky situations on the coast. Grows to 18 inches in length. Not used as food. Examples obtained at Key West and Tampa.

TETRODONTIDÆ.

129. Spheroides spengleri (Bloch). *Swellfish.* Common along the keys and both coasts. Grows to a foot or more in length. Of no importance, except as a curio. Examples from Tampa.

DIODONTIDÆ.

130. Diodon hystrix Linn. *Porcupine-fish.* Not common. Occasionally taken along the southern keys and reefs, and always dried and preserved as a curiosity. I obtained a dried specimen at Key West.

131. Chilomycterus schœpfi (Walbaum). *Swell-toad.* Common on both coasts of Florida. Grows to 8 or 10 inches in length. Not used as food. Inflated, dried, and sold as a curio. Examples from Tampa.

18.—NOTES ON A RECONNOISSANCE OF THE FISHERIES OF THE PACIFIC COAST OF THE UNITED STATES IN 1894.

By HUGH M. SMITH, M. D.,

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NARRATIVE OF THE TRIP.

Under date of May 8, 1894, I was directed by the Hon. Marshall McDonald, U. S. Commissioner of Fish and Fisheries, to proceed to the Pacific coast "for the purpose of making a study of the apparatus and methods of the fisheries of that region." I was instructed to make observations on the condition of the salmon industry of the different sections that it was deemed advisable to visit; to consider the development of the market fishery and the sardine industry; to investigate the history, growth, and present extent of the sturgeon fishery of the Columbia River; and to look into any other branches of the fisheries that possessed special interest. I was directed to give particular attention to the shad, the striped bass, the black bass, the catfish, the carp, and the eel, which have been artificially introduced from the east, especially observing their distribution, size, commercial importance, and food value.

I was ordered to leave Washington on or about May 16, and to return not later than July 10. Pursuant to these instructions, I left Washington May 18 and arrived at San Francisco May 24. Ten days were spent in that city, devoted chiefly to an inspection of the fish and other water products exposed for sale in the markets; to visits to the fishermen's wharf where the catch is discharged, the nets are dried, and the boats are moored; and to an examination of the books of the wholesale dealers for the years 1893 and 1894 for the purpose of taking off an account of all shad, striped bass, carp, and catfish handled. The American Union Fish Company, A. Paladini, G. Camilloni, and J. H. Kessing very obligingly permitted this examination of their records when the object of the inquiry was made known, and are entitled to the thanks of the Commission for this and other courtesies shown. Several other dealers whom it was not possible for me to visit, owing to the short time available, later gave to representatives of the California Fish Commission figures similar to those furnished to me, copies of which were forwarded to this Commission by the California Commission.

On June 2, I went from San Francisco to Los Angeles and San Pedro, chiefly in order to examine the sardine industry centering at the latter place and to interview the proprietors of the cannery, who had offices in Los Angeles. Through the courtesy of Mr. A. P. Halfhill, vice-president of the canning company, who, in San Francisco, had given me a letter of introduction to the superintendent of the cannery, I was enabled to make a very satisfactory examination of the methods of this new, interesting, and important branch of the fisheries during the two days passed in this part of the State. I returned to San Francisco June 6.

At the invitation of Mr. John P. Babcock, chief deputy of the California Fish Commission, I accompanied him and Mr. Wilson, of the fishery protective force, on an official trip in the commission's launch, to the important fishery districts lying between San Francisco and the upper part of the delta of the Sacramento and San Joaquin rivers. I left San Francisco on June 8 and returned June 10, passing the whole of the intervening time in a very interesting and helpful sojourn in the waters named.

The route from San Francisco lay north, past the fishing station of Messrs. Lynde and Hough, in Marin County, and the Chinese fishing-camps, in Marin and Contra Costa counties. San Pablo Bay, Carquinez Strait, and Suisun Bay were then traversed, all of these being important fishing-grounds for salmon, shad, and striped bass. Late in the evening the San Joaquin River was entered and a stop was made for the night at Antioch. Next day a short visit was first paid to Collinsville, on the Sacramento River, where I attended the trial of some gill-net fishermen arrested for violation of the State law prohibiting the setting of gill nets so as to obstruct more than one-third the width of a stream. Although the evidence of an infraction of the law was indisputable, the jury failed to convict, being evidently impressed with the recent decision of a local justice that the law is ambiguous and that the words "more than one-third across the width" of a river may involve the distance between two remotely distant points on opposite sides of the river! During the remainder of the day, the launch cruised through the numerous sloughs intersecting the interesting tule lands of the delta of the Sacramento and San Joaquin rivers, these being the favorite spawning-grounds for shad and striped bass, as well as important fishing-grounds for them and salmon. The forenoon of the following day was spent in the same region, and in the afternoon I returned to San Francisco.

A visit occupying parts of two days (June 12 and 13) was made to Monterey and Pacific Grove from San Francisco. Monterey Bay represents the southern limit of the distribution of the salmon, shad, and striped bass, and is additionally interesting because of the Chinese and other important fisheries there carried on. At El Monte, Mr. B. C. Winston has shown commendable enterprise in bringing together and arranging for exhibition a magnificent mounted collection of the marine algæ of the Pacific coast which has been admired by students of this branch of botany. Mr. Winston has also arranged in a large private exhibition hall many of the rarer and more attractive fishes of that part of the Pacific coast, including sharks, skates, and other large species.

At Pacific Grove, situated at the southern side of the entrance to Monterey Bay, the summer biological school of the Leland Stanford Junior University has been established. This, at the time of my visit, was in charge of Dr. Oliver P. Jenkins, the professor of physiology in the university, by whom the purposes and plans of the school were courteously explained. This is generally conceded to be the best site on the west coast for a biological laboratory. It is located somewhat like Woods Holl with respect to the distribution of the fauna of the northern and southern parts of the coast. The buildings are placed on a rocky bluff at the extremity of the point of land marking the division between the ocean and Monterey Bay. On the rocks at the very doors of the laboratory anemones, echini, mollusks, and other invertebrates can be gathered without the use of apparatus, while the water in the immediate vicinity teems with a great variety of fish and other marine forms of animal life. I was informed by Dr. Jenkins that the university authorities are very desirous that the U. S. Fish Commission shall be represented at the laboratory. There are certainly

many scientific problems affecting the commercial fisheries of the west coast which could here be studied to great advantage.

On June 13 I left San Francisco for Portland, Oreg., where I arrived June 15, and where the three following days were passed in interviewing persons interested in the salmon industry.

While at Portland a day (June 16) was occupied in a visit to the U. S. Fish Commission station on the Clackamas River and to the falls of Willamette River at Oregon City. Both streams were high and muddy. A close personal inspection of the falls disclosed the presence of a large number of salmon immediately below the cascades, although no fish were observed in the act of ascending the falls. The rocks over which the water was breaking and at the sides of the falls were literally covered with lampreys (*Entosphenus tridentatus*) endeavoring to reach the headwaters of the river.

From Portland it was my intention to visit the Cascades and The Dalles, but this had to be abandoned, owing to the high floods, which had caused a discontinuance of fishing, had entirely suspended railroad communication with the upper Columbia, and had rendered water transportation uncertain. This state of affairs made it possible to study the fisheries of only the lower river, which were but little affected by the high water.

Portland was left on June 19 and Astoria was reached on the next day. The three following days were occupied in examination of the canneries and fisheries of that place and vicinity.

My inspection of the important fisheries of the lower Columbia River was greatly aided by Mr. M. J. Kinney, of Astoria, who, in addition to other courtesies, extended the use of his steam launch for a visit to the pound-net and seining grounds at Sand Island and in Baker Bay, thus permitting a closer and more satisfactory study of the conditions than would have otherwise been possible.

I returned to Portland on June 24 and left the next day for Washington, D. C., where I arrived July 2.

GENERAL REMARKS ON THE WEST COAST FISHERIES.

The general commercial fisheries of the Pacific States are of more recent origin than those of any other coast section of the country, and, with the exception of the salmon fishery, they are less developed than those of any other region. It is true that some branches of the fisheries were established before the acquisition of the territory by the United States, but it was only at a comparatively recent date that the taking of the salmon for commercial purposes began, while the utilization of most other fishery resources has had a much later origin. Nevertheless, in the period of thirty years, during which it may be said the fisheries of the west coast have existed, the industry has attained great importance and now ranks next to that of the New England and Middle Atlantic States in extent and value. There seems no reason to doubt that the business will assume vastly greater proportions in the near future, although there is cause to apprehend a decline in several important branches, as, for instance, the salmon, the whale, the fur-seal, and the sea-otter fisheries.

The various phases of the fishing industry of the west coast, including Alaska, give employment to about 17,000 persons, the capital invested amounts to about $8,900,000, and the annual value to the fishermen of the products taken is approximately $7,300,000.

The special fisheries which give this region much of the prominence it possesses are the salmon, the whale, the oyster, the fur-seal, the shrimp, the cod, the crab, and the herring, in the order named. The value of the salmon fishery is about equal to that of all other fisheries combined, while the canning industry connected with the fishery has an annual output but little less in value than that of all the fishery products of the coast. The salmon are by far the most important fishes or fishery products of Alaska, Oregon, and Washington, but in the fisheries of California they are surpassed by whales, oysters, and shrimps.

A conspicuous feature of the fisheries of California is the entire absence of pound nets, trap nets, weirs, and other similar fixed devices. While it is true that a few fyke nets are employed in the Sacramento-San Joaquin delta, their use is so restricted and their importance so slight that they may be dismissed from consideration. The absence of this class of nets, which are such prominent factors in the fisheries of the other States of this region, is owing wholly to legislation. The State has shown a disinclination to permit the use of such appliances, and no very determined efforts have been made by commercial fishermen to secure the repeal of the existing prohibitive law. While the setting of fyke nets is enjoined, the law is not strictly enforced, for the reason that in the opinion of the State Fish Commission the obvious purpose of the act was to prevent the destruction of desirable food-fish, and especially immature fishes; whereas the few nets employed are set in such situations and under such conditions that only fishes generally regarded as worthless, or nearly so, are or can be taken.

In no other region in the United States are the people more generally impressed with the beneficial results of artificial propagation and more ready to aid and approve any fish-cultural measures that are properly recommended. While the results of salmon-culture have in some places been marked and are readily acknowledged by fishermen and others, this alone is not sufficient to account for the widespread advocacy of fish-culture which exists among all classes and in all parts of the Pacific coast. We must look further for the cause. There seems little reason to doubt that to the marvelous success of shad and striped bass acclimatization on the west coast must be attributed the firm belief in fish-cultural work that pervades all localities in which fish is an article of food or an object of capture. One or both of these new species are well known in almost every accessible coast settlement in the three States, and they are an enduring testimony to the influence of man over fish production.

As may be readily understood, the time available for the inspection of the fisheries of the west coast was so short as to preclude a complete study of the subject, and it was necessary to restrict the inquiry to those places which afforded the best opportunity to see the greatest variety of fish and fishing in the shortest time, and to those fisheries possessing the greatest interest and importance.

The chief object of the visit to the Pacific Coast was to give the writer a proper conception of the principal phases of the commercial fisheries there carried on, in order to better equip him for the administration of the affairs of the division under his charge. A great many memoranda were made on the various aspects of different branches of the fishing industry, of which the following notes form a part. Much of personal interest to the writer that was noted, however, would not have sufficient importance to deserve mention in this report.

The notes herewith presented cover only a few of the fisheries of the west coast, and mostly relate to only a few of the phases of those branches which are considered. They represent the personal observations and researches of the writer, and are

selected for incorporation in this report because some of the topics discussed are now the subjects of much attention in the Pacific States, while others have not before been considered and are legitimate news outside of circumscribed geographical limits.

A special object in view in visiting this region was an investigation of the fisheries for shad, striped bass, black bass, catfish, carp, and eel, which have been artificially introduced. A discussion of this important subject, to which much attention was devoted, is, by permission, reserved for a separate report.

SARDINES, ANCHOVIES, AND SARDINE-CANNING.

Notes on the sardine and anchovy of the Pacific coast.—The California sardine (*Clupea sagax*) is very closely related to the sardine of Europe (*C. pilchardus*), from which it chiefly differs in having no teeth and less strongly serrated scales on the belly. It attains a length of nearly a foot. It is found along the entire Pacific coast of the United States. The fish is, however, most constant in appearance and most abundant on the southern part of the coast, and it is doubtful if it exists in sufficient numbers to maintain a regular fishery north of San Francisco. Even at that place the supply is uncertain. While there have been periods of years in which the sardines were found in San Francisco Bay in large quantities, and for a considerable time in each season, for the past five years they have been very scarce.

The distribution of the anchovy (*Stolephorus ringens*) is similar to that of the sardine. It occurs in abundance along the entire coast, and is often found in enormous quantities in Puget Sound, San Francisco Bay, and elsewhere. It reaches a maximum size of about 7 inches. In most places it is known as the anchovy, but in Puget Sound, according to Swan, it is called "sardine."

Prospects and desiderata for sardine-canning.—With the exception of salmon, practically no attention has been given to the canning of fish on the Pacific coast. The packing of salmon has up to this time absorbed nearly all the interest in fish prepared in this way. The question of canning other kinds of fish has, however, been considered; the prospects for the inauguration of profitable work of this kind have been discussed, and, as will hereafter be shown, several factories for the canning of small fish have been built.

The natural advantages which the west coast possesses for the canning of sardines and other similar fish are unusually good, and are superior in some respects to those of the east coast. At least the two fishes named, the sardine and the anchovy, suitable for canning as "sardines," occur in large quantities, the first-named very closely resembling and being an excellent substitute for the sardine of southern Europe. The dry atmosphere and other climatic conditions of the southern coast of California are very favorable for the preparation of a good grade of canned fish. The culture of the olive supplies a native oil of superior quality, which is essential in the canning of the best goods. Another item of importance to canners in this connection is the abundance of cheap labor.

The chief desideratum in the establishment of a factory for the canning of sardines (and other similar fish) is a regular supply of fish during a certain period. This is thought to be of greater importance than an abundance of fish at uncertain or irregular intervals.

While the sardine ranges along the whole western coast of the United States, and is at times very abundant even as far north as Puget Sound, it is doubtful if in Washington or Oregon a supply sufficiently large and regular exists to warrant the

outlay for a cannery. Some years ago, the establishment of a factory for the utilization of sardines was contemplated at the mouth of the Columbia, where, during a brief period in each year, sardines may usually be taken in abundance; but the shortness of the season deterred the consummation of the plan. It is possible that within a few years the canning of sardines may be undertaken in connection with the packing of salmon at a few places on the more northern parts of the west coast, where there is a short run of sardines that can be utilized without the necessity for expensive special machinery, etc. This matter has already received the consideration of some salmon-canners; but the general canning of sardines by salmon-packers is not anticipated so long as the supply of salmon lasts.

Personal observation and inquiry, the testimony of fishermen and dealers, and the studies of ichthyologists afford ground for the belief that the successful operation of a sardine cannery can not be expected any farther north than San Francisco, and the history of the industry at that place seems to indicate that the northern limit of satisfactory work is even farther south. South of San Francisco the prospects of a profitable business appear to be in direct relation to the latitude; the more southern the location of the cannery the more constant and abundant the supply of fish.

It is probable that at some places on the coast, more especially to the northward, the conditions for the successful canning of anchovies are very good. In a paper presented to the World's Fisheries Congress at Chicago, entitled "Notes on the fisheries and fishery industries of Puget Sound,"* Mr. James G. Swan devotes a chapter to the sardine (i. e., anchovy) fishery of that region, and mentions the advantages which the sound possesses for the establishment of a canning industry. Writing of the anchovy, he says:

> When taken in Monterey or San Diego bays, it is only fit for bait; but in Puget Sound, which is its northern limit, it is in perfection, and is one of the fattest and most deliciously flavored of the small fish, and is considered by experts to be far superior, in point of flavor and richness, to the best Mediterranean sardine. Some Norwegian and Russian fishermen here have put them up, in limited quantities, in vinegar and spice, and they are delicious and sell readily; but the men who attempted the enterprise are without capital, and there has been no one with executive ability to push the business forward to a success. The anchovy come to Puget Sound in enormous quantities, and during their season, from May to November, every bay and inlet is crowded with them. When they first come from the ocean they appear in Clallam Bay, on Fuca Strait; then in Port Angeles, Dungeness, and Sequin bays; then in Port Discovery, and next in Port Townsend and Scow bays, where their numbers are almost incredible. I have known them to be in such masses at Port Hadlock, at the head of Port Townsend Bay, that they could be dipped up with a common water bucket, but as there has been no demand for them the fishermen do not consider them of value, and when hauling their nets for smelt they generally let the anchovy escape. The anchovy differ from herring in one respect—the herring, when they visit the bays, keep inshore and are easily caught in seines and landed on the beach; anchovies, on the contrary, keep out in deep water and seldom approach the shore, so that drag seines are of no use to capture them. They can be best taken with purse seines, as mackerel are taken in the Atlantic. As these fish are small, not much over 6 or 7 inches in length, they require a net with a small mesh, and with suitable gear an enormous quantity can be secured.

Sardine-canning at San Francisco.—In June, 1889, a canning factory was established in San Francisco, which continued in operation until August, 1893. During the five years in which the cannery was run the yearly pack was from 5,000 to 15,000 cases.

The canned fish consisted chiefly of anchovies in oil in quarter-pound cans and large sardines in 1-pound and 2-pound round cans. The fish consumed at the factory were caught in San Francisco Bay with haul seines. In the earlier years sardines

*Bulletin U. S. Fish Commission 1893, article 42, pp. 371–380.

small enough for use in quarter-pound cans were obtained, but during the last two years of the cannery's existence no sardines of size suitable for "quarter oils" could be had. This was the chief reason for closing the works.

Sardine fishing and canning at San Pedro.—In June I made a visit to a sardine cannery at San Pedro, in Los Angeles County, which had been established in December, 1893, and is now the only cannery of the kind on the west coast. Sardine-canning is a part of the business of the California Fish Company, of Los Angeles. Through the courtesy of the officers of the company I was enabled to inspect the factory, obtain full knowledge regarding the methods pursued, and gain much valuable information relating to the fishery carried on for supplying the raw material to the cannery.

Fishing for the San Pedro cannery is carried on by a vessel of 22 tons' burden, the motive power of which is furnished by gasoline. The engine has 24-horse power, which is produced by the hourly consumption of one dollar's worth of gasoline. The vessel is sloop-rigged, and when on the fishing-grounds jogs along under sail while looking for fish. Its value is $5,000. Seven men constitute the crew, including a cook.

The vessel carries two purse seines, one of which is used for sardines, the other for mackerel; it is by this apparatus that all the fish are taken. A seine boat and a tender form a part of the equipment. The sardine seine is 120 fathoms long, 50 feet deep, and has a 1-inch (stretch) mesh; its value is about $800.

The fishing-grounds resorted to by the vessel are San Pedro Bay, off Redondo Beach, and around the Catalina Islands. The last named are the best grounds, and fish are there often found in large quantities close inshore in sheltered places.

After the sardines are pursed up in the seine they are bailed into the vessel by means of a hand windlass. They are not dumped in the hold, but are retained on deck by means of a gunwale 12 to 16 inches high. Pending their discharge at the cannery a little salt is spread over them.

The lay on the vessel is as follows: The owners furnish provisions, fuel, apparatus, etc., and meet all running expenses, and pay 1 cent a pound for the fish delivered at the cannery. The captain and cook are paid salaries of $20 and $15 per month, respectively, and the value of the fish is divided among the entire crew. The vessel, however, draws half the share, so that the price actually paid for the fish is one-half cent a pound. In May, 1894, the crew shared about $75 each.

In this region sardines are found throughout the year. They "show" at the surface at times, and thus permit the use of the purse seine. They sometimes go in immense schools. Single hauls of several tons are often made, and 10 tons have on several occasions been taken at a single set of the seine, such a catch being obtained about May 1, 1894. In December, 1893, several very large bodies of sardines were observed, and a haul of 10 tons of small-sized fish was taken. From January to June the fish appear to gradually increase in numbers. Some schools are made up of fish of uniform size, while in others they are mixed. The smallest fish caught are 4 inches long, the largest 12 inches, the average 7 inches.

The condition of the fish as regards fatness varies considerably with the season. Mr. J. H. Lapham, the president of the fish company operating the cannery, states that in December, 1893, when the canning began, the smaller fish were poor while the larger ones were fat. In January and February the conditions were about the same. In March the smaller fish began to improve, continued to grow fatter through April and May, and in June sardines in excellent condition suitable for "quarters oils" were taken. In May, 4 or 5 tons of large fish that were very poor were seined on one occa-

sion. The factory is under the superintendence of an experienced fish-canner from Maine. It is a large two-story structure, with a salting house attached. The plant is worth about $10,000.

The principal processes to which the sardines are subjected before emerging as the canned product are as follows: When the fish are unloaded from the vessel they are received into a large, airy room, where the cutting and washing are done, and then transferred to the second floor by means of an elevator. There they are next arranged on latticed trays (32 inches square) and dried. If the weather is fair and the atmosphere dry the drying is done in the open air, occupying, as a rule, about two and a half hours. On rainy days, or when the air is especially humid, drying is accomplished inside the building by means of steam, which requires about ten hours.

After drying the fish are placed in wire baskets (22 inches long, 18 inches wide, 3 inches deep) and immersed in boiling oil for two to six minutes, depending on their size. The oil is contained in a shallow sink, into which the wire baskets fit and are lowered and raised by means of long wire handles. The boiling of the oil is done by means of a steam pipe entering at the side and running under the sink. After draining and thoroughly cooling the fish go to the packers, thence to the sealers, thence to the bathmen, and, after cooling and testing for leaks, to the boxing room.

The cutting of the fish is done by men and girls, the average number of whom employed is 25. They are paid by the basket or the bucket of cut fish, and by working steadily earn about 25 cents an hour. The flakers number 12 to 14, and are the same girls who pack the fish in the cans. Ten men act as sealers and can-makers, and 10 others are employed in the remaining branches of the work.

The sizes and grades of canned sardines placed on the market from this cannery, and the wholesale prices received, are as follows: Quarter oils, 100 cans to a case, $6.50 to $8.50 per case, according to the quality of the oil; half oils, 50 cans in a case, $5.60 per case; 2-pound oval cans, with mustard, spices, and tomato sauce, $2.25 per dozen cans.

BARRACUDA.

One of the most useful and valuable food-fishes of the California coast is the barracuda (*Sphyræna argentea*). Not only is it a favorite article of food when eaten in a fresh condition, but it is one of the best fish for salting found on the west coast. The normal range of the fish on the coast of the United States is from San Francisco to the Mexican border. It is, however, not generally abundant north of Monterey, and it is a noteworthy feature in the fisheries of only Santa Barbara, Los Angeles, and San Diego counties, in which over nineteen-twentieths of the catch is taken.

There is an active demand for fresh barracuda in the markets of California, and in San Francisco it ranks as one of the choicest fishes.

The annual catch is between 600,000 and 700,000 pounds, of which over 100,000 pounds are salted. The fresh fish yield the fisherman 3 to 5 cents a pound and the salt fish bring 3 to 4 cents a pound. The average wholesale price of the fresh fish in San Francisco is 7 or 8 cents a pound, or two or three times that of chinook salmon.

When properly salted the barracuda presents a very inviting appearance, and is justly regarded as one of the most palatable of fishes that are preserved in this way. It should be, and generally is, split down the belly like codfish. The silvery color of the skin is more or less persistent in salt, and the flesh retains its attractive white character. The largest quantities are salted in San Diego County.

In the spring of 1893 a singular phenomenon attended the appearance of the bar-

racuda on the coast of Los Angeles County. It is thus described in a letter to the Fish Commission from Mr. John L. Griffin, of Los Angeles, dated March 2, 1894:

Barracuda put in an appearance one month earlier than ever before. They came in immense quantities and something happened to them. Thousands came ashore dead, while the water was full of fish that seemed dazed, swimming about with their heads out of water. Among them were some halibut, yellowtails, and some other fish, but they were principally barracuda. All kinds of theories have been advanced; one that fishermen had used dynamite bombs; another that it was caused by volcanic disturbances from the bottom; another that the fish coming from tropical waters became chilled; then another, which the newspapers put forth much to the disadvantage of fishermen and fish-dealers, that it was disease, and there has been a great falling off in the consumption of fish in consequence.

The most plausible explanation of the phenomenon was that there was an unusually active eruption of the submarine oil springs off this coast, and that the fish were asphyxiated by having their gills coated with the oil.

MACKEREL AND MACKEREL-CANNING.

In connection with the capture and canning of sardines at San Pedro, a species of carangoid fish (*Trachurus picturatus*) is taken and utilized to some extent for canning and salting. At San Pedro it is known as "Spanish mackerel"; at other places on the coast it is called "horse mackerel." Dr. Jordan remarks of this fish:

It ranges from Monterey southward to Chile, appearing in California in the summer, remaining in the spawning season, and disappearing before December. It arrives at Santa Barbara in July and at Monterey in August. In late summer it is exceedingly abundant. It forms part of the food of larger fishes, and great numbers are salted for bait. As a food-fish it is held in low esteem, but whether this is due entirely to its small size we do not know. It is identical with the well-known Mediterranean species.

At San Pedro these fish are taken in the small steam vessel used for sardine fishing. A special purse seine, 135 fathoms long and 100 feet deep, with a 2-inch mesh, is used. The fish are caught in San Pedro Bay and around the Catalina Islands. They go in schools of varying sizes. Some large hauls are made; thus, in the fall of 1893, 150 barrels were taken at one set near the Catalina Islands.

The fish caught are mostly of small size. According to the statements of the gentlemen connected with the California Fish Company, the largest taken in their seine are 12 or 14 inches long, the smallest are about 6 inches, and the average length is about 9 inches. The smallest fish are packed in oil in half-pound square cans and in mustard, tomato sauce, and souse in 2-pound oval cans. The fish too large for canning are salted. They are never fat, however, and do not make a high grade of salt fish.

Another species of mackerel, the chub or bull's-eye mackerel (*Scomber colias*), occurs at San Pedro and is utilized to a small extent for canning and salting, as well as being sold fresh. It is there called the "steelhead mackerel." The head is said by the fishermen to be very hard, and in splitting the fish for salting an extra cut of the knife is required to divide the head. The fish is also sometimes designated as the "horse mackerel" in Los Angeles County. It reaches a weight of 3 or 4 pounds, but its average weight is only 2. The flavor and coarseness of the flesh of this fish make it undesirable for canning. Up to the present time, no first-class salt fish of this species have been prepared. The lack of oil in the flesh and the tendency of the latter to assume a dark color are serious drawbacks to the packing of an acceptable salt mackerel.

In the San Francisco market this fish is known as "mackerel," and ranks as a first-class food-fish. The supply is limited, and comes entirely from the southern part of the State. During the early part of June a few boxes of these fish were received by San Francisco dealers, but the bulk of the receipts comes later. The fish examined were of uniform size, having a length of about 16 inches.

THE SALMON INDUSTRY.

CALIFORNIA.

General importance.—Salmon are the most important fish of California, and their capture and utilization constitute one of the most prominent industries of the State. Among all the fishery products of the State, salmon are surpassed in value only by oysters, whales, and shrimps. All the species of salmon found on the west coast occur in the waters of the State in the proper seasons, but the most abundant, generally distributed, and important is the chinook or quinnat salmon (*Oncorhynchus chouicha*). While considerable quantities of salmon are taken each year in Eel River in Humboldt County, and in Smith and Klamath rivers in Del Norte County, the fishing-grounds which give to the salmon fishery the prominence it has attained are the Sacramento River, and Suisun, San Pablo, and San Francisco bays; of these the principal ground is the Sacramento River in Contra Costa and Solano counties.

Salmon in the Sacramento River.—The salmon taken in the important fisheries of the lower Sacramento River are either shipped fresh to market or are sold to the canneries located at Benicia, Black Diamond, and Chipps Island. In the quantity and value of the salmon output, the Sacramento ranks next to the Columbia among the rivers of this coast.

The spring run of chinook salmon in this stream usually begins about the middle of April and continues until the middle of May. In 1894, however, the run began earlier and kept up longer than usual; fish were landed at the canneries on April 4, and the supply lasted into June. As late as May 28 the run was very large, over 1,050 salmon being received at one cannery on that date as a result of only half a day's fishing. At the beginning of the season the run was light, and it was predicted that the catch would be smaller than last year, but afterwards the supply increased, and the close of the season witnessed a larger production than for five years.

The weekly close season from Saturday noon to Sunday midnight is generally observed and vigorously enforced, and is, without doubt, one of the most beneficial regulations affecting the fisheries of the State. The concentration of the fisheries in the proximity of the canneries permits a very large proportion of the fish that ascend the river on Saturday and Sunday to escape capture and molestation and to reach the headwaters of the Sacramento or its tributaries.

There seems no evidence of any improvement in the salmon fishery of the San Joaquin River. The physical conditions appear very unfavorable and distasteful to the migrating salmon. According to the reports of fishermen and members of the California Fish Commission, nearly all the fish which begin the ascent of the San Joaquin are diverted when they reach the Georgiana Slough, the uppermost path of communication between the waters of the Sacramento and San Joaquin rivers. They enter the slough and pass into the Sacramento, and seem to be attracted by the much cooler and muddier waters of that stream. This is in marked contrast with the behavior of the striped bass in the same waters.

In a subsequent chapter the quantities of salmon shipped to San Francisco dealers from the Sacramento River in 1893 and 1894 are shown. The following table gives the number of pounds of fish utilized at the canneries. It appears that the 2 canneries in operation in 1894 received 543,082 more pounds of salmon than the 3 canneries did in 1893, and that the increase over the receipts of the same 2 canneries was 1,255,582 pounds.

Statement of the number of pounds of salmon utilized for canning on the Sacramento River in 1893 and 1894.

Location of canneries.	Spring.		Fall.		Total.	
	1893.	1894.	1893.	1894.	1893.	1894.
Benicia	147,442	297,889	63,200	355,300	210,642	653,189
Black Diamond	292,500	....	520,000	....	812,500	....
Chipps Island	138,125	573,300	335,660	713,520	473,785	1,286,820
Total	578,067	871,189	918,860	1,068,820	1,496,927	1,940,009

The salmon pack of the Sacramento River, as shown in the following table, was 23,336 cases in 1893 and 28,463 cases in 1894. The increase in the output of the two canneries that were in operation both years was 17,627 cases.

Statement of the number of cases of salmon packed on the Sacramento River in 1893 and 1894.

Location of canneries.	Spring.		Fall.		Total.	
	1893.	1894.	1893.	1894.	1893.	1894.
Benicia	2,294	4,668	1,253	5,175	3,547	9,843
Black Diamond	4,500	....	8,000	....	12,500	....
Chipps Island	2,125	8,820	5,164	9,800	7,289	18,620
Total	8,919	13,488	14,417	14,975	23,336	28,463

Salmon trolling in Monterey Bay.—For many years the hand-line fishermen of Monterey Bay, who seek cultus-cod, bonito, rock-cod, etc., have from time to time had their hooks carried away by fish, sometimes supposed to be large bonito, which their lines were not strong enough to retain. Some years ago, when a large body of small mackerel suddenly appeared in the bay and were taken with hand lines, the fishermen, when hauling in the fish, would often have them seized by other fish and taken off, with parts of the line. Occasionally a salmon was caught, but it was not known that salmon would regularly take the hook or that they occurred there in sufficient numbers to warrant a special attempt to obtain them. In 1893, however, a troll-line fishery was established there by anglers which reached large proportions and resulted in the capture of a great many salmon. It was the first year that any formal attempt was made to take the fish in that way or place. The fishing was done principally from Santa Cruz and Capitola. It was carried on from sail and row boats, with stout lines and hooks, attached to fly rods or simply fished by hand. Sardines were used for bait.

The salmon were found in the bay from early in June to about September 1. Some very large catches were made. Mr. G. M. Ord, of Soquel, Cal., took 1,900 pounds in four days, using a nine-ounce fly rod, with sardines as bait. Another man took over 3,500 pounds during a brief visit to the bay.

The following interesting account of this fishery is extracted from an article contributed by Mr. J. Parker Whitney to the issue of "Forest and Stream" for July 29, 1893:

SALMON FISHING WITH FISH BAIT.

This is a comparatively new method of fishing, and one which salmon fishermen are almost entirely ignorant of. To those interested in the king of fishes, the salmon, the harbor of Monterey presents an opportunity of peculiar interest. Here the salmon is found in pursuit of its natural food, and exhibiting many features which give an insight into the ways which have been so mysterious before. Almost yearly the salmon come into the bay of Monterey, as well as that of Santa Cruz and

a few other places on the coast, where they sometimes remain for months, and pursue their feeding as other fish do, and where they are readily caught with fresh-fish bait. I have lately had the great pleasure of taking a few score, and for the benefit of those who, like myself, have been in the habit of taking these noble fish with the fly, I will give the result of my experience.

When the salmon strike in about the bay, and generally near the shore, which occurs here about the 10th of June, they do so in the pursuit of squid, sardines, anchovies, smelts, and other small fish, and their presence is first indicated to the fishermen by the occasional disturbance of the surface water by the small fish in their efforts to escape. This is a signal for the Italians, Portuguese, and other market fishermen to go out for them, which they do in both sail and row boats. These men all fish for the market and waste no time in sentiment. They are equipped with stout cotton lines sufficiently strong to pull in salmon hand over hand. A stout sea hook is used, with a sinker weighing half a pound. The line is about 200 feet in length, the sinker is attached a short distance above the hook, and the line is paid out about 100 feet from the boat, and in the slow sailing or rowing, which is about the same speed as followed in trolling for trout, the bait sinks down 20-odd feet. The sardine or small fish, if not too large, or over 6 inches in length, is put on whole, otherwise it is cut diagonally, making two baits.

The salmon seizes the bait and hook and is pulled in alongside the boat without ceremony, where it is either yanked in or gaffed. Fully half of the salmon hooked are lost by the careless manner of handling, and about two baits are stripped to a salmon hooked. About once in twenty or thirty times two salmon are brought in at one time. I have reason to believe that at times when salmon first come in, and in schools, that the fishermen catch doublets often in succession.

My first experience was in going out with two fishermen in their boat and in witnessing their method. The boat I was in secured three salmon by the hand lines; the other boats did better, some taking as high as eight or ten; about a hundred salmon were taken by the fifteen boats out that morning.

I could find no record of taking the salmon with rod excepting that of my friend Mr. A. L. Tubbs, of San Francisco, from whose information I was induced to look up the fishing. His rod fishing is the only one I have heard of as applied to the salmon in salt water, and I have seen no other during my fishing except that of Mr. Simpkins, of Boston, who accompanied me on one of my fishings and who succeeded in catching one of the largest salmon I have ever seen caught here, weighing 32 pounds. I equipped myself in San Francisco with the best I could get—two cheap bamboo trolling sea-bass rods of 14 ounces and 9 feet in length. My additions were light sea-bass linen lines No. 18, 600 feet long, and No. 4-0 Kirby hooks. The hooks I had soldered to a short link of strong brass wire, to which were attached three more additional brass-wire links, with swivels between, adding to the wire above the shank of the hook a small brass-wire projection without barb, to hold the bait-fish head in position, long half-pound lead sinkers with holes in each end. These, with a multiplying reel, completed my outfit.

The game commences when the salmon is brought toward the surface. Then the salmon will frequently strike off on the surface in a straight line several hundred feet. In two instances I have trembled for my line, being compelled, with all the strain I dared to put on, to allow the fish to take out within 50 or 100 feet of all I had, although the boat was being propelled as rapidly as two men could row toward the fish. But it has been rarely that I have paid out over 400 feet.

Not so often as in fresh water does the salmon leap out of water, and seldom more than two or three times.

My daily catch has averaged nearly eight fish and given most exciting sport. The careful weight of 69 salmon caught I find to be 1,133 pounds, or about 16 pounds each. The smallest was a grilse of 5 pounds and the largest of 30 pounds.

All my catches have been in the early morning, starting out at 4 o'clock and getting back to the Hotel Del Monte in each instance but one for lunch. The exception was an all-day fishing, when I secured 18 salmon, weighing 286 pounds.

As with trout, I have found the morning best, and after 10 o'clock the fishing falls off. Two or 3 miles of rowing has been required to reach the fishing-ground from Monterey pier, and the fishing-ground I have found so far to extend over an area of about 2 miles long by 1 mile wide, although I have no doubt that the salmon could have been found out 2 or 3 miles beyond that limit. I have caught, in addition to the salmon brought in, half a dozen rockfish, called bluefish by the fishermen, but not bluefish as known East, weighing about 5 pounds each; also two codfish of 5 or 6 pounds, and two flounders of 5 and 8 pounds. In a dead calm the fishing about ceases, as with trout in trolling; but

with a return of the breeze the fishing takes on again. The method of taking forcibly reminds me of the trout. Shyly at times, and again boldly, sometimes striking several times at the bait, and with following up and striking at intervals of a few seconds; at times biting off half the bait and in following up for the balance, and in one instance following up the bait with frequent half-decided action until the bait was within 10 feet of the boat and then fiercely seizing it while I had the line in my hand. It proved a close call in a double sense, as the fish was a heavy one of 25 pounds, and carried the line out of my hand and the sinker attached, which rested in the boat, and very nearly got away with my whole outfit. I fortunately still held my rod in hand, and although I paid out nearly the whole of my 600 feet of line, the fish was well hooked and in fifteen minutes was brought to gaff. In boldness and general action the salmon have reminded me constantly of trout, paying but little attention to the boat, occasionally passing in sight within a few feet and striking on the surface at an occasional small fish, and at times going entirely out of the water in pursuit.

For experiment I tried the spoon, but fancied I did not do as well as with bait, although I caught two salmon with it. I also tried the spoon with fish bait, catching one that way, but believe the fish bait alone to be the best. The salmon upon being opened seem to have more squid inside than other fish, although at times full of sardines, and oftener with anchovies. Sardines are, however, the best bait, and squid but indifferent, while I have had some success with smelts and young shad. At one time, out of bait, I used a strip of salmon belly, which did well enough to catch two salmon.

As I have my salmon rods for fly fishing I shall later on try a little surface work with the fly, but I do not anticipate much success; still I believe they will take under favorable circumstances, when they are as plentiful as I am informed by the fishermen they are outside the harbor at times in deeper water, when the fishermen have sometimes observed several salmon at a time, even up to a dozen in number, following the bait up almost to the boat's side.

The fishing in the harbor is in more or less turbid water, with a depth of from 6 to 10 fathoms; while outside of the bay, in deeper water, it is clearer and the salmon can be more distinctly observed. I am informed by the fishermen that at times the salmon are so plentiful a few miles beyond the harbor that they are enabled to fill their boats in a few hours. These occasions, however, are rare, and where the salmon are found plentiful one day they may not be found the next. It has been usual, however, for the salmon to remain about and in the harbor for several weeks each year, although they skip their annual visits occasionally. The small fish which the salmon follow into the harbor come in countless numbers, often in large, moving masses, and their presence is indicated to the fishermen by the hovering sea gulls, pelicans, and other predatory birds. These are seen busily at work on the salmon-grounds, and often indicate the most favorable places for fishing. While the salmon evidently come in schools at first, it would appear that they scatter more or less about, instead of remaining together, although they mass more or less when in the vicinity of large schools of small fish. The fishermen are more or less guides for each other, and they may be scattered over a square mile without doing much in catch. Presently one or two commence hauling in, which congregate all the others in the vicinity, and the fishing goes on merrily for awhile. Then a scattering takes place again, and a regathering afterwards. Still, I have found about as good success in passing up and down in certain localities as in following the fishing boats.

The market fishermen, as I have previously observed, lose fully half of the salmon they hook; it is a straight overhand pull, and no give except that which is compelled by want of strength. The line and hooks are strong, and the fishermen have no time to wait. If the salmon are plentiful they do not much mind the losses, which often occur from neglect in using the gaff. With the light rod, the fish, if hooked, is seldom lost. I brought in several with skin holds, which would not have been held for a moment in hand fishing. One salmon which I caught had been on one of the market fishermen's line and had a torn hook-mark in his mouth and a cruel gaff cut between his ventral and anal fins. The gaff cut was nearly 3 inches long, and had penetrated nearly to his other side, and was too serious to have ever healed up again. The fish was a large one, of about 21 pounds in weight, and in fine condition, although the gaff cut was evidently two or three days old. The wound had evidently made but a slight impression on the appetite of the fish, as it struck fiercely and fought hard. * * *

I found the salmon which exhibited the most gamy qualities to do their fighting near the surface, seemingly to disdain any depth after once being brought up, and to often make an almost complete circuit of the boat. Certainly a more beautiful sight than a salmon exhibits, with his brilliant colors as he strokes along with his powerful tail near the surface in the clear water and bright light, never gladdens the heart of a fisherman. We all know the dangers to which the salmon is exposed in fresh

water, and from which but few survive, as it is doubtful if but very few, if any, ever return from the upper streams which they ascend after the spawning season, at least when such upper waters are far removed from the sea. If they have the exposures in the deeper waters of the sea which follow them in the shoal water of Monterey Bay, their lives are indeed beset with constant risk. I saw daily in the bay on the fishing-grounds the enemies and consumers of the salmon at their deadly work, in the form of seals, porpoises, sharks, and cowfish. One day when I was out, which was very foggy, I was startled by the uprising of a curiously peaked hump two boat lengths ahead. It seemed to me like a boat's end elevated with a black cloth over it, but a moment later revealed the half of an enormous bewhiskered sea lion, which, raising itself half out of the water, revealed a form which must have weighed at least a ton. In its mouth was a large salmon, which it had evidently just caught. The insatiable appetite of these monsters of the deep, of which hundreds abound in the vicinity, would indicate that they are not slow to avail themselves of the salmon invasion. Well, I thought, the part which man plays in the devastation of the salmon in the sea is but trifling compared with that which occurs from their natural enemies beneath the waters.

It is clear that the salmon of Monterey Bay are those which belong to the Sacramento or San Joaquin River group. Their average weight confirms this, and that they are not of the Columbia River. The distance from Monterey Bay to San Francisco Bay, into which the Sacramento and San Joaquin rivers pour, is about 90 miles. Monterey Bay and that of Santa Cruz, a few miles north, and at some of the sounds and bays north on the coast, are the only places known where the salmon is found engaged in taking his food, and where it can be caught with fresh-fish bait. It certainly presents a favorable opportunity for studying the salmon in its normal condition, in its prime, engaged in seeking its natural food. Here its manners and peculiarities can be examined with ease, and some knowledge obtained of the class of food upon which it best thrives. All this can be obtained and the salmon brought to gaff in his superior condition before the advanced condition of the organs of reproduction have reduced its delicious flavor or weakened the vigor of its efforts.

This year the fishery promises to be much more extensively followed than last year. Professional fishermen owning boats and regular boatmen will resort to the bay from more or less remote places. Early in June some fish were taken, but a period of stormy weather drove them off. On June 13 some fishing was going on.

An interesting point connected with this subject is that these are undoubtedly the fish that constitute a part of the fall run of salmon in the Sacramento River. Last fall the Sacramento River fishermen took a number of salmon in their nets which had hooks in their mouths—clearly fish which had been snagged in Monterey Bay.

THE COLUMBIA RIVER.

Explanatory remarks.—The time was insufficient and the conditions not suitable for an examination of the salmon fisheries of the entire river. The extremely high water had seriously affected the fishing in the whole upper river, and a visit at that time would not have been satisfactory even if the indefinite suspension of railroad traffic and the uncertainty of water transportation had not rendered the contemplated visit to the Cascades and The Dalles impracticable.

The inquiry which gave promise of the most satisfactory results was the examination of the important fisheries and large canning interests of the lower river, which were easily accessible and afforded the opportunity of inspecting every prominent method of fishing in the river except that with wheels. It was therefore in Astoria, the great center of the salmon industry in the river, that most of the time available for the examination of the Columbia River basin was passed. Here and in Portland, where some time was also spent, it was possible to meet fishermen and canners from all parts of the river.

The accompanying memoranda on the salmon industry simply represent mostly the personal inquiries and observations of the writer, and are far from being a complete account of the business. Many things were observed which, while of great interest

to the person who for the first time visits this region, would have too little general importance to deserve mention. In order to render the notes more complete, an account of the salmon industry for the year 1894 is presented, although the season was only half over at the time of the writer's visit. The information for the latter part of the season has been obtained chiefly by correspondence. The detailed tabular matter here offered is in all cases drawn from the books of canners or fishermen, and may be accepted as accurate.

The salmon fishery and canning industry in 1893.—The fishing season of 1893 on the Columbia River was noteworthy for two reasons—the loss of life among the fishermen of the lower river was never greater; the pack of chinook salmon was the smallest in twenty years, that is, since 1873; and the general pack was less than in any previous year since 1874, with the exception of 1887 and 1889.

Much of the loss of life among the gill-net fishermen in the past has been due to gross carelessness or foolhardiness on the part of the men in venturing too near the bar at the mouth of the river in the hope of taking the fish when they first leave the ocean. It is said, however, that the disastrous death rate in 1893 was in large part unavoidable, and was due to the occurrence of sudden gales, which took the boats unawares. In the early part of June gales resulted in the death of 34 men, and by the close of the season the loss of lives reached 54, about 40 of the men being married. The money losses in boats and gear aggregated nearly $20,000.

In the early part of May the canners acceded to the demands of the gill-net fishermen's union for a price of 5 cents a pound for chinook salmon instead of the uniform rate of $1 per fish which had formerly prevailed. Reference to tables of averages elsewhere given will show that the average weight of chinooks taken with gill nets in 1893 was 22.86 pounds, so that the prices received amounted to an advance over 1892 of 14 cents on each fish sold; on this basis the fishermen must have been benefited by the change to the amount of fully $75,000.

Fishing with all forms of apparatus in the lower river was less satisfactory than in the previous year. The average catch of salmon by gill nets was more than 100 less to a boat than in 1892, the figures given being 450 against 565. The traps were scarcely half as successful as in the previous season, being injured by storms and freshets and being shunned to a considerable extent by the large runs of fish, owing, as some suppose, to a shallowing of the water by the accumulations of sand and sediment caused by the thousands of stakes. Seine fishing began later than usual and was unsuccessful generally. The run of chinooks in August was very large, and is said to have obviated what would otherwise have been a somewhat disastrous season to the packers. While May was the best month for gill nets and July for pound nets, the catch of both these forms of apparatus in August was large. The run during the whole of the open season in August was reported to be extraordinarily heavy, and when the season closed there was still an enormous body of fish passing up the river. The total pack to August 10 was reported to be about 365,000 cases, of which about 290,000 cases were chinooks. Compared with the pack of the year 1883, ten years previously, when only chinook salmon were canned, the decrease in chinooks was 58 per cent and in the total pack was 45 per cent.

The number of salmon canneries operated in the Columbia basin in 1893 was 24, of which 13 were in Oregon and 11 in Washington. They were located as follows:

Locality.	County.	Number.
Oregon:		
Astoria	Clatsop	8
Clifton	do	1
Dalles	Wasco	1
Maple Dell	Multnomah	1
Warrendale	do	1
Portland	do	1
Total		13
Washington:		
Bay View	Wahkiakum	1
Brookfield	do	1
Cathlamet	do	1
Chinook	Pacific	1
Eagle Cliff	Wahkiakum	1
Eureka	do	1
Ilwaco	Pacific	2
Knappton	do	1
Pillar Rock	Wahkiakum	1
Waterford	do	1
Total		11
Grand total		24

The reduced pack led some of the canners to resume the business when the close time was over and the fall fishing began on September 10. At that time there was a numerous run of salmon in the river. By some these were regarded as small chinook salmon, by others they were thought to be dog salmon. Judging from the size, 10 to 15 pounds on an average, it seems probable the fish were dog salmon (*Oncorhynchus keta*). If so, this was the first year any business was made of packing them on the Columbia, although they were rather extensively canned on some of the coast streams in 1892. The fish were known as "chums" in the lower river. The boats could go out from Astoria and return loaded in a few hours. The price at first was 5 cents per fish, but it quickly dropped to 2 cents per fish, and even then the demand was far below the supply. The canners could doubtless have packed three or five times as many as they did. They were restrained in packing these fish extensively by their poor quality when canned. When fresh the fish were fine-looking, with firm flesh and a good color to their meat. When canned, however, they bleached out and became white or straw color. They could only be sold as third or fourth class goods, bringing $3.20 per case. The quantity canned was about 20,000 cases.

The unusual feature of the fall packing operations was the utilization of humpback salmon (*O. gorbuscha*). The canners paid 5 cents each for the fish. According to Mr. M. J. Kinney, between 2,500 and 5,000 cases were prepared. Some of the raw material came from Puget Sound. A few silver salmon (*O. kisutch*) were also canned.

Condition of the salmon industry in 1894.—The regular salmon-fishing season of 1894 began April 10 and ended August 10. During the months of May and June the success of this industry was seriously jeopardized by the occurrence of unprecedentedly high freshets, which constituted one of the principal features of the season. A later extraordinarily large run of salmon overbalanced the injurious effects of the floods.

During the height of the flood the operations of the gill-net fishermen were interrupted, but by the middle of June the gill nets began to take large numbers of fine chinooks, and are reported to have done well during the remaining part of the season. The run of fish continued large to the very end of the season. On August 7, three

days before the suspension of fishing, 45 tons of chinooks, equivalent to over 3,600 fish, were landed at one cannery in Astoria. Taking the season through, the year was the best one for gill nets in a long time. According to Mr. Kinney, many gill-net crews took 13 tons of fish, and one caught $17\frac{1}{2}$ tons, equivalent to over 1,700 fish.

The catch of blueback salmon in traps had been unusually large up to the time of the writer's visit (June 22), and advices received after the suspension of the fishery reported a general continuance of the run. Some daily catches of single nets and sets of nets in June were larger than corresponding weekly lifts during the previous season. The season's run was said to have been larger than for five or six years. In the upper river, notwithstanding the destruction of wheels by high water, the catch of bluebacks was at times almost unprecedented. The yield of steelheads was also large.

The catch of chinook salmon in traps was, however, remarkably small. Up to June 22 some traps had taken only 200 pounds of chinooks, and during the whole season the quantities of chinooks obtained in this way were much below the average.

The prices agreed on by the canners and fishermen of the lower river were 5 cents a pound for chinooks, 4 cents a pound for bluebacks, and 2 cents a pound for steelheads. The condition of the industry on June 15 is thus described in a dispatch from Astoria, published in the *Oregonian*, of Portland, on June 16:

The run of salmon has improved greatly, and the catch of the gill-net men to-day was greater than for any day in the history of the canning business for many years past. During the warm and pleasant weather of the last ten days hundreds of boats could be seen out around the jetty. The success of the gill-net men does not, however, mean that their receipts are in excess of those of the corresponding time last year. As yet the traps have yielded but small returns, while seining is out of the question, owing to the high water. Cannery men claim that while the gill nets may take enough fish to pack 100,000 cases more than were packed last year from the same sources of supply, the shortage in receipts from seines, traps, and fish-wheels will reach fully 200,000 cases. This view of the situation is borne out by the fact that orders for over 50,000 cases are known to have been canceled during the past two weeks.

By the end of the month the estimated shortage was considerably reduced, and as the season wore on it became apparent that instead of a shortage there would be a larger pack than in 1893.

The canneries operating in the Columbia basin in 1894 numbered 24 and were located as follows:

Locality.	County.	Number.
Oregon:		
Astoria	Clatsop	9
Clifton	do	1
Dalles	Wasco	1
Maple Dell	Multnomah	1
Warrendale	do	1
Portland	do	1
Total		14
Washington:		
Bay View	Wahkiakum	1
Brookfield	do	1
Cathlamet	do	1
Chinook	Pacific	1
Eagle Cliff	Wahkiakum	1
Eureka	do	1
Ilwaco	Pacific	1
Knappton	do	1
Pillar Rock	Wahkiakum	1
Waterford	do	1
Total		10
Grand total		24

Detailed figures from separate canners have been obtained by correspondence, which place the pack at 461,400 cases, of which 183,400 cases were prepared at Astoria, 204,000 at other places in the lower river, and 74,000 cases at the Cascades and The Dalles. The proportion of the different species constituting the pack is estimated to be about as follows: Chinook, 69 per cent or 318,366 cases; bluebacks, 16 per cent or 73,824 cases, and steelheads, 15 per cent or 69,210 cases.

The foregoing figures apply only to the regular packing season, which terminated August 10. When the close time expired on September 10, some of the canneries resumed operations and continued to pack until November 10. From information received from Mr. M. J. Kinney, it appears that about 70,000 cases, chiefly of silversides, were prepared in the fall. Mr. Kinney states that it would have been an easy matter to pack double that quantity had the fishing been carried on with sufficient energy.

Statistics of salmon pack from 1866 to 1894, inclusive.—From 1866, the year in which the salmon-canning industry on the Columbia River was established, to 1894, the quantity of salmon utilized for canning purposes was about 695,400,000 pounds, and the aggregate pack was about 10,633,800 cases, each holding 48 one-pound cans, or the equivalent. The value of the pack to the canners was about $61,760,500. Up to and including 1887 practically the entire quantity of salmon utilized in canning consisted of chinook salmon. Since that year larger and larger quantities of steelhead, blueback, and other salmon have been used and the number of chinook salmon entering into the pack has been reduced in the same proportion.

The following table shows for each year the gross weight of salmon utilized for canning, the number of cases packed, the wholesale market value of the canned fish, and the average value per case. The growth, decline, and present condition of the industry are to be interpreted in the light of the statement in the preceding paragraph as to the utilization of the cheaper grades of salmon. The figures, as they stand, indicate a serious decline in the industry since the business reached its height in 1883 and 1884. The extent of the decline is made more apparent when the greatly augmented quantities of apparatus employed in recent years are taken into consideration. With the number of fishing appliances employed in 1894, a pack in that year a half larger than that in 1884 would really indicate a serious reduction in the supply of fish.

Summary of the salmon-canning industry of the Columbia River from its origin to the present time.

Year.	Gross weight of salmon utilized.	Number of cases packed.	Value.	Average value per case.	Year.	Gross weight of salmon utilized.	Number of cases packed.	Value.	Average value per case.
	Pounds.					*Pounds.*			
1866	260,000	4,000	$64,000	$16.00	1882	35,184,500	541,300	$2,600,000	$4.80
1867	1,170,000	18,000	288,000	16.00	1883	40,911,000	629,400	3,147,000	5.00
1868	1,820,000	28,000	392,000	14.00	1884	40,300,000	620,000	2,915,000	4.70
1869	6,500,000	100,000	1,350,000	13.50	1885	35,997,000	553,800	2,500,000	4.51
1870	9,750,000	150,000	1,800,000	12.00	1886	29,152,500	448,500	2,135,000	4.76
1871	13,000,000	200,000	2,100,000	10.50	1887	23,140,000	356,000	2,124,000	5.97
1872	16,250,000	250,000	2,325,000	9.30	1888	24,211,005	372,477	2,327,981	6.25
1873	16,250,000	250,000	2,250.000	9.00	1889	20,685,495	309,885	1,809,820	5.84
1874	22,750,000	350,000	2,625,000	7.50	1890	28.781,385	435,774	2,407,456	5.52
1875	24,375,000	375,000	2,250,000	6.00	1891	26,450,635	398,953	2,240,964	5.62
1876	29,250,000	450,000	2,475,000	5.50	1892	32,185,995	487,338	2,679,069	5.50
1877	24,700,000	380,000	2,052,000	5.40	1893	25,672,152	393,972	2,135,824	5.42
1878	29,900,000	460,000	2,300,000	5.00	1894*	30,452,400	461,400	2,422,350	5.25
1879	31,200,000	480,000	2,640,000	5.50					
1880	34,450,000	530,000	2,650,000	5.00	Total	690,499,067	10,563,799	61.480,464	....
1881	35,750,000	550,000	2,475,000	4.50					

*The figures given do not include the fall pack for 1894, amounting to about 70,000 cases.

Preservation and increase of the salmon supply.—It is not unnatural that the solicitude for the maintenance of the supply of salmon on the Columbia River should now be greater and more general than at any previous time in the history of the fishery. The catch of chinook salmon has recently shown an almost constant annual decrease, and the success of the industry is yearly becoming more jeopardized. People who within a short time scouted the idea of a permanent reduction in the number of chinook salmon entering the river, are now not averse to conceding the effects of overfishing, and there is probably no one pecuniarily interested in the industry who does not realize that the time has come for active measures to prevent a still more serious impairment of the abundance of salmon. Of course the supply of chinook salmon in the Columbia Basin is still enormous and the productive capacity of the river is wonderful. All reference, therefore, to a decreased abundance must be construed in the relative sense as compared with the conditions prevailing when the acme of the canning industry was attained in 1884 and 1885. The threatened exhaustion of the supply must also be considered with reference to the extent of the fishing now carried on, which is not only commensurate with the supply, but is overtaxing the capacity of the river. The facts must also be borne in mind that the annual reduction is hastened by the employment of larger and larger quantities of apparatus; that as the supply becomes smaller the diminution becomes more pronounced in geometrical ratio; and that the results of overtaxation of the resources of the river in a given season are not seen the next year or the next, but are to be gauged in the fourth or fifth year following.

Special inquiries were made by the writer among the salmon-canners, fishermen, and citizens as to the legislative or other action demanded by the present condition of affairs. The practical unanimity of opinion is remarkable in view of the supposed diverse interests represented by canners, gill-net fishermen, trap fishermen, seine fishermen, wheel fishermen, etc.

Foremost among the measures advocated for the improvement of the salmon industry is artificial propagation. The reliance placed in fish-culture is practically unanimous. Some believe that nothing else is necessary for the regeneration of the fishery than very extensive fish-cultural operations, but most persons in the salmon districts think that, for a time at least—until the fishery begins to improve—the propagation work should be supplemented by some prohibitive measures.

It being generally recognized that the decline in the abundance of chinook salmon is due to the fact that the length of the fishing season and the avidity with which the fishery is prosecuted prevent a sufficient number of salmon reaching the spawning-grounds to repair the annual destruction by man, the character of the protection which has been considered most necessary is a shortening of the fishing season, supplemented by a short weekly intermission in the fishing.

Under present regulations the regular salmon-fishing on the Columbia River begins April 11 and continues until August 10. In the opinion of the U. S. Commissioner of Fish and Fisheries, if the fish that are now taken in April and August were allowed to pass up unmolested, a very marked improvement in the abundance of salmon would in due time be witnessed, and this protection, with ample artificial propagation, would rapidly restore the productiveness of the river.

The Commissioner may be quoted on this point as follows:

The number of chinook salmon taken in April and August is relatively small and under conditions not so profitable, either to the canneries or the fishermen, as those carried on during the months of May, June, and July. The April run of this salmon, if allowed to pass without interruption to the headwaters of the Columbia and its tributaries, would spawn in those waters, and the present productive capacity of the river would be increased to such an extent as to much more than compensate for the restrictions imposed by the prohibition of the fishery operations during the month of April. The August run of chinook salmon consists of gravid fish near their spawning time. The flesh for this reason has undergone deterioration, and if canned constitutes an inferior product, the sale of which will discredit the reputation which the Columbia River salmon justly hold in public estimation. None of the August run of chinooks probably ascend the Columbia above The Dalles. They spawn in the tributary streams of the Lower Columbia and in the main stream between The Dalles and the mouth of the river.—(Report of the Commissioner of Fish and Fisheries on Investigations in the Columbia River in regard to the Salmon Fisheries. Washington, 1894. pp. 16, 17.)

As the Commissioner states, the packing of salmon in April is not generally regarded as profitable, owing to the irregularity with which the fish come and the relative scarcity, because of which much time is lost by the canning force. As to the August fish, they are usually so near the spawning period that the flesh is soft and often unfit for canning, and much waste results; the fish are also often scarce and the supply is insufficient to keep the canneries in operation. It sometimes happens, however, that the season is late and the August run consists of an abundance of fish in excellent condition for canning. In some seasons the fish are more abundant and in better condition in August than in any other month, and in 1893 the run of fish in the month in question contributed much to the financial success of the canners.

The sentiment of the canners in the lower river is strongly favorable to the restriction of the canning season to the three months of May, June, and July, and the suspension of fishing during the whole of April and August. A few canners favoring a shorter season would like the privilege of packing in August if they thought it desirable, and still fewer would prefer to operate their canneries in April.

That, as a whole, no conspicuous part of the pack is taken in April and August, and that making a close time of these months would not seriously impair the business of the canners, may be seen from the following summary based on the quantities of fish packed during each of the four years ending in 1892:

Percentage of weight of each kind of salmon packed on the Columbia River in each month in 1889, 1890, 1891, and 1892.

Years and species.	April.	May.	June.	July.	August.	Total.
1889.						
Chinook	12.47	21.81	23.61	42.11	....	100.00
Blueback	15.78	32.93	35.49	15.80	....	100.00
Steelhead	5.77	9.03	38.47	46.73	....	100.00
1890.						
Chinook	3.66	26.50	28.29	39.99	1.56	100.00
Blueback	8.59	27.55	40.42	20.44	3.00	100.00
Steelhead	3.97	8.31	31.65	50.45	5.62	100.00
1891.						
Chinook	8.74	19.09	23.73	42.22	6.22	100.00
Blueback	9.05	28.70	43.50	16.83	1.92	100.00
Steelhead	2.72	6.99	27.67	51.44	11.18	100.00
1892.						
Chinook	6.05	20.61	26.33	37.76	9.25	100.00
Blueback	9.90	35.38	37.86	14.67	2.19	100.00
Steelhead	2.41	7.51	32.32	45.63	12.13	100.00

A fairly accurate gauge of the sentiment of those prominently interested in the industry of the river as to the measures favored for the preservation of the salmon supply may be obtained from the following tabulated statement, representing the results of interviews with canners, public men in salmon-fishing centers, and State fishery officers, chiefly in Astoria and Portland, the canners predominating:

Favoring extensive artificial propagation to exclusion of any restrictive measures	1
Favoring extensive artificial propagation and close time throughout month of April	*3
Favoring extensive artificial propagation and close time throughout month of August	*2
Favoring extensive artificial propagation and close time throughout the months of April and August	†13
	19

In the case of the apparatus in the upper river, that is, in the section between the Cascades and Celilo, a close time extending to May 10 or 15 in spring and an extension of the open season to August 10 or 15 would be a proper modification of the close season advocated for the lower river, as the fish which entered the river during the last two weeks in April would be given opportunity to pass unmolested beyond the wheels. In lieu of such an arrangement, the establishment of a graduated close time for different parts of the river or of a moving zone of protected water has been suggested. Wheel fishermen would probably not object to such a plan. Those interviewed expressed themselves as favoring a close time till May 10 or 15, provided the course was considered advisable for the protection of the fish.

It may be stated that any suggestion of a shortening of the season on the Columbia River will probably be opposed by a large majority of the gill-net fishermen and many persons using other forms of apparatus, under the impression that a curtailment of the season would mean a reduction in their income, whereas the opposite result would probably ensue.

The prohibition of certain forms of nets has from time to time been suggested and advocated. In the lower river the use of wheels has by a few persons been opposed on the ground that the fish which have escaped the multitude of nets in the part of the river below the Cascades should be allowed to pass unmolested to the spawning-grounds. Those interested in the wheel fishing, on the other hand, say that the quantities of chinook salmon taken in wheels are insignificant as compared with those caught by other means in the lower river, and that if more salmon were allowed to pass as far as the wheels the supply would be much better maintained by natural means. It can not be said, however, that the desire to proscribe any special kind of fishing apparatus is very prevalent, and the entire canning interests would probably strenuously oppose any attempt to abolish traps, seines, or wheels, for the reason that these appliances are largely owned or controlled by them, and afford the principal means for successfully withstanding what are considered unjust demands of the Fishermen's Union, which advocates the use of no form of apparatus save the gill nets.

* All of these, while preferring to suspend fishing during only one of the months in question, would probably not be averse to having a close time in both, if deemed necessary or desirable by competent authority.

† One also favoring abolition of wheels.

Salmon in the Willamette and Clackamas rivers.—It is reported by fishermen and sportsmen that only the early run of chinook salmon goes up the Willamette River, as it is only in spring that there is sufficient current in that stream to attract fish ascending the Columbia; later, the water becomes sluggish, and the summer run of salmon passes by the mouth of the river.

In 1894, owing to an unusually large volume of water, many salmon are said to have gone over the falls of the Willamette at Oregon City, but it seems clear that in ordinary seasons, when there is no special increase in the amount of water at the falls, great difficulty must be experienced by the migrating fish in surmounting them. The construction of one or several fish-ladders at the falls is urgently needed, and is now more important than at any previous time.

It is gratifying to be able to record the fact that at the last session of the Oregon legislature provision was made for the construction of a fishway at the Willamette Falls. The plans for the location, building, and maintenance of the ladder are thus described in the *Oregonian* for August 10, 1894:

Governor Pennoyer, State Treasurer Metschan, and Secretary of State McBride, constituting the State board which was authorized by the last legislature to locate a fishway over the Willamette Falls, will take the first step in that direction to-day. The governor, treasurer, and secretary, with State Fish Commissioner McGuire, Hon. George T. Myers, and several other gentlemen, will meet in Oregon City to-day, and proceed to the falls and select a location for the fishway.

For the construction of this fishway the legislature appropriated the sum of $10,000, but it will cost much less. By the provisions of the law the fishway shall be constructed in the bed of the river on the west side of the main fall, by making excavations in the solid rock when the water is low, so that the slope will be more gradual, and when the water is higher the excavations will form a series of connecting pools, all constructed and arranged in such manner that salmon can freely ascend from below to above the falls by passing from pool to pool.

In order to have the fishway built in the manner provided, the board is empowered to remove all obstructions, whether natural or artificial, to its construction, or to the passage of fish over the falls. Obstructions to the passage of fish include fish-wheels, nets, lines, and other devices for catching fish stationed within 50 feet of the fishway. The maintenance of such obstructions is a misdemeanor, and is punishable by a fine or imprisonment, or both.

The board is authorized to make all necessary arrangements for the construction of the fishway, such as employing a superintendent and workmen, purchasing tools and supplies, and advertising for bids. All bidders must agree to keep the fishway in good order for two years after its completion.

The existence of a dam in the Clackamas River is generally recognized as one of the greatest evils now affecting the fisheries of the Columbia River basin. Not only is this obstruction annually destroying millions of undeposited ova and practically inhibiting natural reproduction in the headwaters of the river, but it is seriously impairing the operations of the hatching station of the U. S. Fish Commission located on that stream. The enactment of a law is earnestly desired requiring the owners of dams in all salmon streams to put in *and maintain* suitable fishways, which should be subject to the approval and regulation of the State fish commissioners. In the case of streams like the Clackamas, on which Government or State hatcheries are located, it would seem that the great interests at stake would warrant the absolute prohibition of dams or other obstructions, and, possibly, the proscription of all fishing.

According to Mr. Seaburg, of Ilwaco, Wash., one of the most extensive salmon-packers in the United States, in April and May, 1893, about 140 tons of chinook salmon were taken below the dam in the Clackamas River by means of gill nets and seines. The principal part of this relatively large catch was taken at the dam, where the fish congregated in their attempts to surmount that obstruction. In 1894 over 100 tons were taken in the same locality.

There is no doubt that the natural conditions in the Clackamas are extremely favorable for the breeding of salmon, and the foregoing statement of the catch in that stream in 1893 and 1894 clearly indicates that an enormous annual production of young salmon might be depended on if the fish were not subject to capture and obstruction. It is equally true that noninterference with the salmon which have escaped the traps, seines, and gill nets of the Columbia and reached the Clackamas would permit the hatching station there located to liberate enough young salmon each year to go far toward repairing the diminution in the supply caused by excessive fishing.

Mr. L. T. Barin, who has been fishing on the Columbia and its tributaries for more than thirty-four years, informed me that, as a result of his personal observations in every important branch of the Columbia, he has no hesitation in affirming that the Clackamas always was and still is the best tributary salmon stream in the whole basin.

The continuance of present conditions, however, can not fail to have a far-reaching effect on the abundance of salmon in the lower Columbia River, and an accelerated diminution of chinooks may be depended on as a direct result of the obliteration of the run into the headwaters of the Clackamas.

Notes on apparatus and the catch.—Under this head some general notes on the principal forms of apparatus and the catch in each may be presented, and some detailed statistics, showing the yield of certain nets in 1892 to 1894, may be introduced.

As is well known, gill nets take larger quantities of chinook salmon than all other nets combined. While the proportion of fish thus obtained naturally varies from year to year, the gill-net yield always so far overbalances the remaining catch that it affords an accurate basis for determining the abundance of the fish, while it is evident that any regulations intended to increase the supply of chinooks must have primary application to the gill-net fishery. The importance of the gill net as a factor in the taking of chinooks will be clearly seen from the following comparative statement of the number of these fish obtained on the Columbia River, with all forms of apparatus and with gill nets alone, during the period of five years beginning 1889:

Statement of the total number of chinook salmon taken on the Columbia River from 1889 to 1893, with the number and percentage of those caught with gill nets.

Year.	Total catch.	Gill-net catch.	
		Number.	Percentage.
1889	772,425	478,097	61.90
1890	942,884	580,871	61.61
1891	963,779	657,133	68.18
1892	916,833	578,912	63.14
1893	872,317	544,984	62.48
Total	4,468,238	2,839,997	63.56

The employment of small-meshed gill nets has of late been increasing, and in 1894 was more extensive than ever before. The regular mesh of salmon gill nets is $8\frac{1}{2}$ to $9\frac{1}{4}$ inches, while the smaller-meshed nets which have been coming into use have a 7-inch mesh.

The principal reason for the increase in the use of small-meshed nets has been the change in basis for selling the catch effected in 1893. Prior to that time the gill-net fishermen were paid so much per fish regardless of size, although two fish under a given weight (22 pounds) were required to count as one full-sized fish. The

practice of selling fish by weight caused no discrimination against the smaller fish, which now bring as much per pound as the larger ones, and led to the use of nets with smaller mesh with a view to increase the catch by taking the fish which might otherwise go through the nets without gilling.

The increase in the use of small-meshed gill nets may, to some extent, be gauged by the additional quantities of blueblacks and steelheads taken, and in future an augmented catch of these fish by gill nets may be expected.

The following detailed statements, showing for three years the daily catch of four gill-net fishermen fishing at the mouth of the Columbia River and landing their catch at Astoria, are interesting as indicating the daily fluctuations in the run of salmon and because they afford a basis for comparisons with other years. The figures were selected from the books of the salmon-canner to whom the fish were sold, for the special reason that the men fished more or less regularly each year and their work represents the capacity of the river. In 1892 the fish are designated by number; in the following years the figures represent pounds. The statement for 1894 comes up to June 20, the time of the writer's visit.

Statement of the daily gill-net catch of four fishermen fishing at the mouth of the Columbia River in 1892.

Date.	No. 1.			No. 2.			No. 3.			No. 4.			Total.		
	Chinooks.	Bluebacks.	Steelheads.	Chinooks.	Bluebacks.	Steelheads.	Chinooks.	Bluebacks.	Steelheads.	Chinooks.	Bluebacks.	Steelheads.	Chinooks.	Bluebacks.	Steelheads.
	No.	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*
Apr. 12	15						1						16		
16	17												17		
19	9												9		
20										7	1		7	1	
21	9						9						18		
23	9						5			5			19		
26				4			13			5			22		
27	15												15		
28				7			15			4			26		
29	2												2		
Total	76			11			43			21	1		151	1	
May 2							1			4			5		
3	14						5			3			22		
4										2			2		
5	13												13		
6							2						2		
7	5			1			1			9			16		
10	8						10			4			22		
11	7			4									11		
12							1			3			4		
13	3			3			11			3			20		
14	5						26	1		12		1	43	1	1
16	12												12		
17	13												13		
18							26			4			30		
19	9			7						12			28		
20	18						29						47		
21	8			6			31						45		
23	27												27		
24				16			18			19			53		
25	17						50			16	1		83	1	
26	28			21						7			56		
27	44			6			23			11			84		
28	8						24			27			59		
30	19			32			43			9			103		
31	24			15			12						51		
Total	282			111			313	1		145	1	1	851	2	1

Statement of the daily gill-net catch of four fishermen fishing at the mouth of the Columbia River in 1892—Continued.

Date.	No. 1.			No. 2.			No. 3.			No. 4.			Total.		
	Chinooks.	Bluebacks.	Steelheads.	Chinooks.	Bluebacks.	Steelheads.	Chinooks.	Bluebacks.	Steelheads.	Chinooks.	Bluebacks.	Steelheads.	Chinooks.	Bluebacks.	Steelheads.
	No.	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*
June 1				15			24			18			57		
2	43			12			27			20		2	102		2
3							14			14			28		
4	8						15			9			32		
5															
6	32												32		
7	14						24		1				38		1
8							55						55		
9	15			26						32			73		
10							25			36		1	61		1
11	16			29			27			55			127		
13				66			17						83		
14	33						17			22		1	72		1
15	11						13			16		2	40		2
16				3									3		
17				4			15			6			25		
18	9		1	9			17			8			43		1
20	8			24		1	18		1				50		2
22	18		1	25		2	21		1	19		3	83		7
23				4		1	5		1	6		1	15		3
24	16	1	2	3		2	25			7		1	51	1	5
25	23	1	2	6						29		2	58	1	4
26															
27				28	1	3	57	1	9				85	2	12
28	14												14		
29										37			37		
30	26	2	2	17		1				26			69	2	3
Total	286	4	8	271	1	10	416	1	13	360		13	1,333	6	44
July 1	9						20		4				29		4
2				5			19		2	17			41		2
3	57		6	5						17			79		6
4	11			9			22			21		2	63		2
5	8			7		1							15		1
6							8		1	29		1	37		2
7	11			10									21		
8				6		1	41		1	31			78		2
9	28		17	4			41		2	43		1	116		20
11	4			69		2	7		1	11		2	91		5
12				5			44			14		1	63		1
13	20		1	32		2	78		2	16		1	146		6
14	11		2	2		1	6		1	15		1	34		5
15	3		3	5			43		4	37		4	88		11
16	3			3		1	5			19		2	30		3
18	36						7						43		
19	8			14			10		1	11			43		1
20	8						6		1	2			16		1
21	5			11			9			18			43		
22				6			6			27			39		
23	15		1				5			4			24		1
25	9			21									30		
26	7			2			15			31		1	55		1
27	6			1			15		1	6			28		1
28							14			2			16		
29	22			15		1	15		1	11			63		2
30	11			10			9			8			38		
31	55									57		1	112		1
Total	347		30	242		9	445		22	447		17	1,481		78
Aug. 1				4			25						29		
2	5						17			31			53		
3	9		1				10		1	23			42		2
4	2						7						9		
5	4						9			11			24		
6							3			2			5		
Total	20		1	4			71		1	67			162		2
Grand total	1,011	4	39	639	1	19	1,288	2	36	1,040	2	36	3,978	9	125

Statement of the daily gill-net catch of four fishermen fishing at the mouth of the Columbia River in 1893.

Date.	No. 1.		No. 2.		No. 3.		No. 4.		Total.	
	Chinooks.	Steelheads.	Chinooks.	Steelheads.	Chinooks.	Steelheads.	Chinooks.	Steelheads.	Chinooks.	Steelheads.
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Apr. 17	303								303	
18	80	80							80	10
22	72		69				82		223	
24	392		90				86		568	
25	107								107	
26	175								175	
27	187		131						318	
28	317						88		405	
29	287	10	168				358		813	10
Total	1,920	20	458				614		2,992	20
May 1	160				138		259		557	
2	279		106		221		355		961	
3	632				408		276		1,316	
4	141								141	
5	120	*5	27		319			20	466	25
6					141				141	
8	38				373				411	
9	266				122				388	
10	425				516		69	20	1,010	20
12	62		55		414		71		602	
13	105		311		408		455		1,279	
15	251		92	10	33		194		570	10
16	583		66		155		227		1,031	
17	390		180		335				905	
18	424		158		379		284		1,245	
19	472		152		366		152		1,142	
20	120		83		1,027		1,325		2,555	
22	173		48		738		355		1,314	
23	398		127		265		472		1,262	
24	518		418		256		124		1,316	
25			221		150		65		436	
26	238		313				17		568	
27	549		57				37		643	
29	914		106		1,914		117		3,051	
30	221		258				466		945	
31					167		244		411	
Total	7,479	5	2,778	10	8,845		5,564	40	24,666	55
June 1	56		156	10	222				434	10
2	1,036	10	164		569				1,769	10
3	721		92		408				1,221	
5			75						75	
6	214								214	
7	333		431						764	
8	382	20	179						561	20
9	169		278						447	
10			97						97	
12	431	10	140		50				621	10
13	299	10	82		24				405	10
14	229	10							229	10
15	373		53				82		508	
16	777	20	223		65		157		1,222	20
17	706	30	156		306	20	205	20	1,373	70
19	105	10	1,076		691	60	399	20	2,271	90
20	361	40	471		146		41		1,019	40
21			123	10	498				621	10
22			200		158		82		440	
23	57		93		87				237	
24	184	10	136		136		46		502	10
26	124		141		171	20	70		506	20
27	116	10	128		180	10	108	20	532	40
28	623		39		296		132		1,090	
29	111	10	65		894	10	175	20	1,245	40
30	154		52		85	10	281		572	10
Total	7,561	190	4,650	20	4,986	130	1,778	80	18,975	420

* Blueback.

Statement of the daily gill-net catch of four fishermen fishing at the mouth of the Columbia River in 1893—Continued.

Date.	No. 1.		No. 2.		No. 3.		No. 4.		Total.	
	Chinooks.	Steelheads.	Chinooks.	Steelheads.	Chinooks.	Steelheads.	Chinooks.	Steelheads.	Chinooks.	Steelheads.
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
July 1	248	....	53	....	156	....	335	....	792	....
2	387	....	220	....	337	....	178	....	1,122	....
4	....	....	60	....	....	....	....	....	60	....
5	....	....	....	....	149	....	....	....	149	....
6	....	....	....	....	....	....	20	....	20	....
10	21	....	104	....	162	....	79	....	366	....
11	55	....	121	....	390	....	....	....	566	....
12	92	....	121	....	46	....	110	....	369	....
13	128	....	110	....	189	....	142	....	569	....
14	189	....	56	....	140	....	217	....	602	....
15	276	....	323	....	68	....	183	....	850	....
17	376	....	472	....	144	....	338	....	1,330	....
18	....	....	....	....	141	....	80	....	221	....
19	263	....	106	....	907	....	....	....	1,276	....
20	250	....	60	....	127	....	58	....	495	....
21	120	....	164	....	307	....	112	....	703	....
22	....	....	27	....	295	....	136	....	458	....
24	96	....	655	....	601	....	267	....	1,619	....
25	92	....	214	....	168	....	50	....	524	....
26	418	....	89	....	38	....	68	....	613	....
27	447	....	74	....	71	....	46	....	638	....
28	194	....	....	....	391	....	168	....	753	....
29	679	....	85	....	946	....	408	....	2,118	....
30	....	....	....	....	....	....	....	....	....	....
31	298	....	160	....	1,315	....	589	....	2,362	....
Total	4,629	....	3,274	....	7,088	....	3,584	....	18,575	....
Aug. 1	462	....	232	....	285	....	246	....	1,225	....
2	118	....	311	....	248	....	192	....	869	....
3	40	....	438	....	364	....	87	....	929	....
4	461	....	518	....	304	....	356	....	1,639	....
5	286	....	67	....	258	....	78	....	689	....
7	369	....	300	....	1,832	....	404	....	2,905	....
8	665	....	600	....	672	....	490	....	2,427	....
9	513	....	....	....	580	....	103	....	1,196	....
10	85	....	292	....	74	....	115	....	566	....
11	86	....	65	....	....	....	46	....	197	....
Total	3,085	....	2,823	....	4,617	....	2,117	....	12,642	....
Grand total	24,674	215	13,983	30	25,536	130	13,657	120	*77,850	495

Statement of the daily gill-net catch of four fishermen fishing at the mouth of the Columbia River in 1894 (to June 20).

Date.	No. 1.		No. 2.		No. 3.		No. 4.		Total.	
	Chinooks.	Steelheads.	Chinooks.	Steelheads.	Chinooks.	Steelheads.	Chinooks.	Steelheads.	Chinooks.	Steelheads.
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Apr. 10	196	....	....	....	....	....	....	....	196	....
12	....	....	....	....	185	....	....	....	185	....
13	112	....	....	....	....	....	....	....	112	....
14	252	....	....	....	....	....	....	....	252	....
16	....	....	....	....	166	....	....	....	166	....
17	352	....	....	....	103	....	37	....	492	....
18	....	....	22	....	350	....	....	....	372	....
19	297	....	....	....	....	....	....	....	297	....
21	297	....	91	....	315	....	....	....	703	....
23	554	10	55	....	547	....	....	....	1,156	10
24	....	....	....	....	....	....	107	....	107	....
25	290	....	....	....	262	....	....	....	552	....
26	....	....	....	....	57	....	153	....	210	....
27	....	....	....	....	71	....	....	....	71	....
28	....	....	61	....	....	....	....	....	61	....
29	361	....	....	....	....	....	....	....	361	....
Total	2,711	10	229	....	2,056	....	297	....	5,293	10

Statement of the daily gill-net catch of four fishermen fishing at the mouth of the Columbia River in 1894 (to June 20)—Continued.

Date.	No. 1.		No. 2.		No. 3.		No. 4.		Total.	
	Chinooks.	Steelheads.	Chinooks.	Steelheads.	Chinooks.	Steelheads.	Chinooks.	Steelheads.	Chinooks.	Steelheads.
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
May 1	155		48		550		260		1,013	
2			89		248				337	
3			152				79		231	
4					182		119		301	
5	250		25		105		25		405	
7	604				285		18		907	
8			39						39	
9			180		278				458	
10	275		137		292		311		1,015	
11	636		70		606		237		1,549	
12	267		120		138		172		697	
15	188		49		130		86	5	453	5
16	245				533				778	
17			310		76				386	
18	312		249		62		218		841	
19	298		164		185		672		1,319	
20										
21	1,013		525		1,165		1,438	10	4,141	10
22	678		124						802	
23			297						297	
24	132		254		222		314		922	
25	480	22	495		581		466		2,022	22
26	197		159		144		125		625	
28			115		462		284		861	
29	227		485		195				907	
30	324								324	
31	444		411		620		535		2,010	
Total	6,725	22	4,497		7,059		5,359	15	23,640	37
June 1	350		345		340		459		1,494	
2	1,010				15				1,025	
3										
4					483		80		563	
5	403		305						708	
6					350				350	
7	344		626		290		633		1,893	
8	390				508		674		1,572	
9	249		113		142		49		553	
11	1,025		128		525		238		1,916	
12							345	9	345	9
13	285	12			99		1,248		1,632	12
14	368	29	939		547		65		1,919	29
15	1,711	31	425		184	12			2,320	43
16	 159	*6 32	510		887	22	180		1,736	60
18	1,260	10	737		355	6	896	20	3,248	36
19			201				234	11	435	11
20			841		304	14			1,145	14

* Blueback.

The great multiplication of pound nets in the lower Columbia, especially in Baker Bay and around Sand Island, is a feature of the salmon fisheries which impresses a visitor very forcibly. The nets form such a maze on the Washington side of the river that it seems impossible for salmon entering the river west of Sand Island to escape capture, and it would appear that access to so many nets is cut off by the lines of other nets that a large proportion of the traps would fail to pay expenses.

A Washington law requires that each trap set in the waters of the State shall be licensed. In 1893, 460 traps were licensed to fish in the Columbia River, of which 442 were in Baker Bay. In 1894 the number was 410, of which 387 were in the bay, as I am informed by Mr. James Crawford, the fish commissioner of Washington. Most of these are owned in Oregon and are properly credited to the fisheries of that State. The law also requires that a space of 800 feet be left between each line of traps and a space of at least 50 feet between the bowl of one net and the leader of the next.

The catch of chinooks in pound nets is larger than in any other apparatus except

gill nets, and the chinook is by far the most valuable species taken in the pounds. More bluebacks than chinooks, however, are secured in pound nets some seasons, the yield of the former usually being larger than in any other forms of nets except wheels. The catch of steelheads is always larger in pound nets than in other appliances.

The quantity of salmon taken with seines is less than with any other important form of apparatus. The number of seines used is relatively small, and the investment in this kind of fishing apparatus is insignificant compared with that in gill nets, pound nets, or wheels. In ordinary seasons more chinooks than any other species are caught in seines, although in seasons when there is a particularly heavy run of bluebacks in the river, as, for instance, in 1892, the catch of bluebacks is largest. The number of seines used on the Columbia is usually about forty, most of which are operated in the lower river near its mouth.

The following figures represent the results of a seine fishery in the lower Columbia in 1892, 1893, and 1894, the record for the last year being incomplete. In the first year the fishing season was from April 20 to August 11. In 1893 seining operations did not begin till June 30. The figures are given to show the variations in the catch of different species from month to month and the relative quantities of each taken by this means. The catch of this seine is larger than the average for the river, being 124,353 pounds in 1892 and 66,673 pounds in 1893.

Statement of the daily catch of chinook, steelhead, and blueback salmon in a seine fished at Brownsport Sands, opposite Pillar Rock, Columbia River, in 1892, 1893, and 1894 (to June 1).

Date.	1892.			1893.			1894.		
	Chinooks (pounds).	Blue-backs (pounds).	Steel-heads (pounds).	Chinooks (pounds).	Blue-backs (pounds).	Steel-heads (pounds).	Chinooks (pounds).	Blue-backs (pounds).	Steel-heads (pounds).
April 20	501	600	....	....	....	....	....	....	....
22	452	285	....	....	....	....	....	....	....
25	407	211	....	....	....	....	155	120	49
26	340	104	....	....	....	....	....	....	....
27	....	....	....	....	....	....	123	67	17
28	670	279	....	....	....	....	....	....	....
29	312	200	....	....	....	....	....	....	....
30	788	394	....	....	....	....	....	....	....
Total	3,470	2,073	....	....	....	....	278	187	66
May 3	319	373	....	....	....	....	248	96	96
4	894	671	....	....	....	....	....	....	....
5	1,097	535	....	....	....	....	47	....	....
6	791	115	....	....	....	....	295	....	96
7	1,035	1,064	....	....	....	....	....	....	....
8	....	....	....	....	....	....	78	121	8
9	629	537	....	....	....	....	129	480	16
10	1,144	1,052	....	....	....	....	165	616	....
11	1,734	1,929	....	....	....	....	209	544	27
12	1,413	1,764	....	....	....	....	137	516	....
13	958	1,327	....	....	....	....	....	....	....
14	1,197	2,711	....	....	....	....	....	....	....
15	....	....	....	....	....	....	327	912	44
16	623	244	....	....	....	....	196	1,052	....
18	492	278	....	....	....	....	398	752	71
19	378	218	....	....	....	....	411	276	15
20	461	596	....	....	....	....	....	....	....
21	1,138	597	....	....	....	....	190	94	17
23	305	47	....	....	....	....	109	....	118
24	730	38	....	....	....	....	....	....	....
25	789	116	....	....	....	....	....	....	....
27	....	....	....	....	....	....	299	94	35
28	227	22	....	....	....	....	....	....	....
Total	16,354	14,234	....	....	....	....	3,238	5,553	543
June 7	160	36	....	....	....	....	....	....	....
9	473	30	64	....	....	....	....	....	....
10	1,010	62	54	....	....	....	....	....	....
11	473	113	62	....	....	....	....	....	....

Statement of the daily catch of chinook, steelhead, and blueback salmon in a seine, etc.—Continued.

Date.	1892.			1893.			1894.		
	Chinooks (pounds).	Blue-backs (pounds).	Steel-heads (pounds).	Chinooks (pounds).	Blue-backs (pounds).	Steel-heads (pounds).	Chinooks (pounds).	Blue-backs (pounds).	Steel-heads (pounds).
June 13	628	81	58						
14	563	100	35						
15	664	129	63						
17	912	166	126						
18	2,324	342	332						
20	699	610	77						
21	1,096	365	314						
23	657	452	266						
24	1,033	722	255						
25			84						
28	37	32	42						
29	138	72	85	298	193	175			
30				302	102	220			
Total	10,867	3,312	1,917	600	385	395			
July 1	458	41	234	279	203	152			
2	799	41	250						
3				563	134	184			
4	1,565	80	302	505	94	299			
5	464	67	208	752	83	421			
6	376		225	318	93	508			
7	280		287	389	37	533			
8	224		173	486	27	224			
10				628	103	146			
11	776		165	1,092	64	645			
12				850	118	521			
13	574		253	725	50	526			
14	465		199	669	96	570			
15	728		211	436	43	442			
16	1,504		773						
17				685	3	402			
18	863		212	787	5	303			
19	3,680		1,294	801	14	374			
20	2,542		1,278	850		311			
21	1,905		932	905		538			
22	1,586		1,213	1,376	35	414			
23	1,077		496						
24				4,168		1,057			
25				3,744		593			
26	1,706		1,367	2,007		931			
27				1,292		480			
28	487		587	2,169		374			
29	2,369		587	1,208	119	212			
30	7,410		2,212						
31				1,858		601			
Total	31,838	229	13,458	29,542	1,321	11,761			
Aug. 1				2,258	269	209			
2	3,777		742	2,920	220	366			
3	3,948		1,542	881	71	155			
4	2,635		1,389	844	106	315			
5	2,570		767	364	38	13			
6	2,194		1,437						
7				1,421	223	40			
8	1,952		1,129	3,058	261	304			
9				1,618	165	600			
10	1,325		239	1,680	248	699			
11	610		345	1,699	389	1,235			
Total	19,011		7,590	16,743	*1,990	3,936			
Grand total	81,540	19,848	22,965	46,885	1,706	16,092	3,516	5,740	609

* The quantities shown in this column for August represent small chinook salmon, mostly under 4 pounds in weight, and are not included in the grand total.

The following table, relating to the year 1893, and applying to that part of the Columbia River adjacent to Astoria, shows by months the number of different kinds of salmon taken by certain gill nets, pound nets, and seines, respectively, the entire catch of which was landed at a cannery, from the books of which the figures were drawn. The fish here shown are the same as those whose average weights are recorded in another place in this report.

Table showing the monthly catch of chinook, blueback, and steelhead salmon in a certain number of gill nets, pound nets, and seines employed at the mouth of the Columbia River in 1893.

Months.	Gill nets. (April 17 to August 10.)					Pound nets. (April 17 to August 10.)				
	Number of nets used.	Number of fish taken.				Number of nets used.	Number of fish taken.			
		Chinooks.	Bluebacks.	Steelheads.	Total.		Chinooks.	Bluebacks.	Steelheads.	Total.
April	115	6,409	2	18	6,429	40	416	208	59	683
May	160	23,468	16	17	23,501	75	1,793	1,792	207	3,792
June	165	22,008	91	511	22,610	75	3,350	5,466	4,137	12,953
July	168	15,917	3	847	16,767	75	6,550	1,801	10,031	18,382
August	135	12,892	....	647	13,539	75	3,109	....	2,305	5,414
Total	....	80,694	112	2,040	82,846	....	15,218	9,167	16,739	41,224

Months.	Seines. (June 20 to August 10.)					Total number of fish taken.			
	Number of seines used.	Number of fish taken.							
		Chinooks.	Bluebacks.	Steelheads.	Total.	Chinooks.	Bluebacks.	Steelheads.	Total.
April	....	....	....	....	....	6,825	210	77	7,112
May	....	....	....	....	....	25,261	1,808	224	27,293
June	3	158	229	426	813	25,516	5,786	5,074	36,376
July	5	5,889	413	5,827	12,129	28,356	2,217	16,705	47,278
August	5	2,872	....	1,555	4,427	18,873	....	4,507	23,380
Total	....	8,919	642	7,808	17,369	104,831	10,021	26,587	141,439

Detailed statistics for salmon wheels.—Through the courtesy of Mr. Frank M. Warren and Dr. John Williamson, of Portland, Oreg., the following detailed data are presented, showing, for a period of years, the daily catch of salmon by certain wheels operated at the Cascades of the Columbia, which is the lowermost part of the river where the use of wheels is possible. The number now operated there annually is about 35, and about 23 more are employed in the upper river at The Dalles and Celilo.

The following figures, which have been drawn from the records of Mr. Warren, the owner of the wheels, show, for a series of eleven years, terminating in 1894, the daily catch of each kind of salmon in one wheel fished on the Oregon side of the river and one on the Washington shore. The catch of the wheels in question was selected for detailed presentation because they were operated continuously during each season and the yield represents the productive capacity of that part of the river for wheel fishing. The uncertainties attending the prosecution of this fishery; the influence of the volume of water on the catch; and the daily, monthly, and annual fluctuations in the abundance of the different salmon are well exhibited in the tables. The data are also valuable for the comparisons that may be made. Separate figures are given for the salmon weighing 20 pounds or more and those weighing less than 20 pounds.

The aggregate catch of the two wheels in question during the years 1883 to 1894, inclusive, was 804,693 marketable salmon, as shown in the following summary. Of these, 163,526 were chinooks, 589,183 were bluebacks, and 51,984 were steelheads. The latter have only recently come into use, and the catch is not reported prior to 1887. The largest number of fish, namely, 134,144, was taken in 1886; the smallest number, 1,677, in 1894, while in 1889, owing to the low state of the water, the wheels could not be used. The catch of chinooks was larger in 1884 than in any other year; it will be recalled that the acme of the canning industry on the river was then attained. The blueback yield was largest in 1886. The biennial character of the run of this fish, of

which mention is elsewhere made, is well illustrated by these figures. On comparing 1884, 1886, 1888, 1890, and 1892 with 1883, 1885, 1887, 1891, and 1893, it appears the catch during the former series was 341,253 fish, and during the latter 246,881 fish.

Summary of the yearly catch of salmon in two wheels located, respectively, on the Oregon and Washington sides of the Columbia River, at the Cascades.

Years.	Chinooks.	Bluebacks.	Steelheads.*	Total.
	Number.	*Number.*	*Number.*	*Number.*
1883	20,908	75,121		96,029
1884	27,902	83,219		111,121
1885	12,049	59,208		71,257
1886	13,641	120,503		134,144
1887	21,984	80,166	5,356	107,506
1888	11,996	40,978	6,105	59,079
1889				
1890	23,161	74,419	8,094	105,674
1891	4,089	10,448	1,557	16,094
1892	12,572	22,134	14,074	48,780
1893	14,670	21,938	16,724	53,332
1894	554	1,049	74	1,677
Total	163,526	589,183	51,984	804,693

* Not utilized prior to 1887. The fish caught were given away.

The following tables illustrate the monthly variations in the abundance of chinooks and bluebacks during each of the years mentioned. The largest catch of both fish is obtained in June; in April and August the yield is insignificant.

Statement of the number of chinook salmon taken monthly in two wheels located, respectively, on the Oregon and Washington sides of the Columbia River, at the Cascades, from 1883 to 1894, inclusive.

Years.	April.	May.	June.	July.	August.	Total.
1883		5,057	7,393	8,458		20,908
1884		3,787	15,393	8,722		27,902
1885		3,123	7,102	1,824		12,049
1886		410	11,427	1,804		13,641
1887		3,228	7,395	11,271	90	21,984
1888	12	2,666	6,593	2,725		11,996
1889						
1890		13,331	8,979	851		23,161
1891		1,072	2,878	139		4,089
1892		281	7,908	4,359	24	12,572
1893	8	1,487	8,710	3,912	553	14,670
1894	34	520				554
Total	54	34,962	83,778	44,065	667	163,526

Statement of the number of blueback salmon taken monthly in two wheels located, respectively, on the Oregon and Washington sides of the Columbia River, at the Cascades, from 1883 to 1894, inclusive.

Years.	April.	May.	June.	July.	August.	Total.
1883		5,108	59,621	10,392		75,121
1884		4,350	65,392	13,477		83,219
1885		5,296	42,717	11,195		59,208
1886		2,161	111,400	6,942		120,503
1887		5,283	38,544	36,339		80,166
1888	187	4,281	31,014	5,496		40,978
1889						
1890	88	12,176	54,670	7,485		74,419
1891		1,922	7,583	943		10,448
1892		6,203	11,334	4,591	6	22,134
1893	12	1,783	12,515	7,544	84	21,938
1894	10	1,039				1,049
Total	297	49,602	434,790	104,404	90	589,183

The maximum height of water shown in the tables was 30 feet 8 inches in 1894. Shortly after that point was reached the wheels were washed away, and the water

continued to rise till June 8, when it attained a height of 41 feet 9 inches. The lowest water record was 10 feet 6 inches at the beginning of the season of 1893. Very few fish comparatively are taken when the water is under 15 feet high. The poorest season, when the fishing was not suspended on account of too low water or too high water (as in 1889 and 1894), was in 1891. In that year the maximum height of water was only 19 feet 5 inches, and only during the first ten days in June was the water over 19 feet. In 1884, the best year for these wheels, the water was over 20 feet during the entire time from May 20 to July 8. In 1886, when the most bluebacks were taken, the water was 20 feet or over from May 27 to June 30.

The following tables give, in detail, the daily catch of the wheels referred to:

Statement of the daily catch of salmon in two wheels located, respectively, on the Oregon and Washington sides of the Columbia River at the Cascades, with a record of the height of water above low-water mark.

Date.	Height of water.		Oregon.					Washington.				
			Small chinooks.	Large chinooks.	Blue-backs.	Steel-heads.	Total.	Small chinooks.	Large chinooks.	Blue-backs.	Steel-heads.	Total.
1883.	*Ft.*	*in.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
May 14	19	0	45	6	85	....	136	....	....	....	....	....
15	20	4	28	9	58	....	95	....	....	....	....	....
16	21	3	11	2	23	....	36	....	....	....	....	....
17	21	6	20	3	32	....	55	....	....	....	....	....
18	21	8	52	2	45	....	99	4	....	16	....	20
19	21	10	62	14	94	....	170	9	....	36	....	39
21	21	9	236	78	224	....	538	22	4	62	....	88
22	21	7	259	167	360	....	786	38	4	81	....	123
23	21	6	252	208	330	....	790	53	12	104	....	169
24	22	0	190	214	253	....	657	48	13	77	....	138
25	22	7	176	130	368	....	674	38	5	37	....	80
26	22	10	176	115	316	....	607	72	13	174	....	259
28	22	3	232	244	238	....	714	71	26	192	....	289
29	21	10	250	245	474	....	969	53	19	155	....	227
30	21	10	237	273	392	....	902	56	14	144	....	214
31	22	2	256	231	576	....	1,063	52	8	168	....	228
Total.	....		2,482	1,941	3,868	....	8,291	516	118	1,240	....	1,874
June 1	22	3	229	244	664	....	1,137	57	16	184	....	257
2	22	3	136	208	756	....	1,100	43	4	224	....	271
4	22	4	52	104	820	....	976	40	22	560	....	622
5	22	2	69	91	1,760	....	1,920	23	11	288	....	322
6	22	1	50	102	1,680	....	1,832	45	11	608	....	664
7	22	1	96	144	2,196	....	2,436	46	24	536	....	606
8	22	1	88	118	2,480	....	2,686	51	24	527	....	602
9	22	2	109	186	2,464	....	2,759	44	32	696	....	772
11	23	2	81	85	1,237	....	1,403	48	36	264	....	348
12	23	9	62	81	2,796	....	2,939	44	13	296	....	353
13	24	4	112	140	4,288	....	4,540	59	30	616	....	705
14	24	7	145	101	4,116	....	4,362	....	....	....	....	....
18	23	9	131	131	2,296	....	2,558	56	24	503	....	583
19	23	8	78	205	4,036	....	4,319	76	30	648	....	754
20	23	11	146	210	4,166	....	4,522	....	....	....	....	....
21	24	1	122	202	3,816	....	3,140	....	....	....	....	....
22	24	2	167	212	2,264	....	2,643	24	6	296	....	326
23	24	3	176	143	1,896	....	2,215	68	16	368	....	442
25	24	0	56	159	1,264	....	1,479	66	12	408	....	486
26	23	11	121	116	3,216	....	3,453	90	26	336	....	452
27	23	10	64	55	840	....	959	67	17	328	....	412
28	23	10	55	82	1,024	....	1,161	80	18	384	....	482
29	23	10	73	82	984	....	1,139	72	13	272	....	357
30	23	9	113	77	924	....	1,114	79	21	296	....	396
Total.	....		2,541	3,268	50,983	....	56,792	1,178	406	8,638	....	10,222
July 2	23	9	172	99	784	....	1,055	72	8	168	....	248
3	23	9	162	133	752	....	1,047	106	19	160	....	285
4	23	6	285	279	832	....	1,396	88	18	208	....	314
5	23	3	325	384	880	....	1,589	55	14	136	....	205
6	22	11	353	337	903	....	1,593	32	5	104	....	141
7	22	6	366	335	832	....	1,533	16	9	80	....	105
9	21	11	113	210	368	....	691	28	19	64	....	111
10	21	6	225	292	560	....	1,077	30	20	56	....	106
11	21	1	256	204	504	....	964	....	....	....	....	....
12	20	9	257	177	368	....	802	28	18	40	....	86
13	20	5	220	166	424	....	810	44	35	40	....	119
14	20	1	212	188	464	....	864	20	29	16	....	65
16	19	4	105	61	264	....	430	32	51	16	....	99

Statement of the daily catch of salmon in two wheels, etc.—Continued.

Date.	Height of water.	Oregon.					Washington.				
		Small chinooks.	Large chinooks.	Blue-backs.	Steel-heads.	Total.	Small chinooks.	Large chinooks.	Blue-backs.	Steel-heads.	Total.
1883.	*Ft. in.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
July 17	18 11	159	116	254	....	529	77	76	16	....	169
18	18 6	155	184	488	....	827	66	89	16	....	171
19	18 0	179	175	307	....	661	60	69	24	....	153
20	17 5	85	53	146	....	284	46	53	8	....	107
21	17 0	31	8	102	....	141	22	43	8	....	73
Total.	....	3,660	3,401	9,232	....	16,293	822	575	1,160	....	2,557
Grand total.	....	8,683	8,610	64,083	....	81,376	2,516	1,099	11,038	....	14,653
1884.											
May 12	....	....	....	....	....	....	52	2	48	....	102
13	16 9	65	3	160	....	228	91	8	56	....	155
14	17 8	123	5	216	....	344	32	2	16	....	50
15	18 1	40	2	88	....	130	....	....	....	....	....
16	18 3	161	7	312	....	480	24	2	32	....	58
17	18 6	179	10	388	....	577	32	2	24	....	58
19	19 5	237	20	264	....	521	76	4	88	....	168
20	20 1	248	19	160	....	427	72	2	80	....	154
21	21 0	124	14	80	....	218	41	3	72	....	116
22	21 9	122	9	152	....	283	32	1	72	....	105
23	22 3	96	10	120	....	226	52	1	64	....	117
24	22 5	247	17	232	....	496	104	11	108	....	223
26	22 9	241	40	264	....	545	136	17	88	....	241
27	23 2	154	25	136	....	315	124	8	68	....	200
28	23 9	186	34	216	....	436	36	4	40	....	80
29	24 5	96	15	138	....	249	24	2	16	....	42
30	24 10	72	9	160	....	241	28	....	48	....	76
31	24 9	100	2	280	....	382	28	2	64	....	94
Total.	....	2,491	241	3,366	....	6,098	984	71	984	....	2,039
June 2	24 0	221	23	344	....	588	138	22	136	....	296
3	24 2	423	77	744	....	1,244	220	32	256	....	508
4	24 8	468	86	904	....	1,458	124	28	216	....	368
5	25 4	180	70	432	....	682	78	21	232	....	331
6	25 10	173	66	704	....	943	48	9	264	....	321
7	26 3	202	95	752	....	1,049	56	11	136	....	203
9	26 8	276	76	1,184	....	1,536	100	21	200	....	323
10	26 7	284	84	1,640	....	2,008	136	42	228	....	406
11	26 7	324	126	2,768	....	3,218	120	37	496	....	653
12	26 9	356	109	1,776	....	2,241	156	70	624	....	850
13	27 3	232	68	2,096	....	2,396	84	25	400	....	509
14	27 2	163	42	1,788	....	1,993	4	....	48	....	52
16	26 11	210	52	2,592	....	2,854	80	20	440	....	540
17	26 9	343	122	3,344	....	3,809	52	25	320	....	397
18	26 6	466	231	3,994	....	4,691	232	63	712	....	1,007
19	26 2	475	266	3,680	....	4,421	296	161	1,408	....	1,865
20	25 9	359	232	2,752	....	3,343	248	60	1,238	....	1,546
21	25 8	395	192	3,440	....	4,027	142	64	576	....	782
23	25 6	319	128	2,984	....	3,431	136	38	656	....	830
24	25 6	511	219	3,632	....	4,362	196	67	1,016	....	1,279
25	25 4	318	126	2,080	....	2,524	72	4	416	....	492
26	25 4	258	116	1,560	....	1,934	152	47	1,320	....	1,519
27	25 3	284	138	1,992	....	2,414	104	18	592	....	714
28	24 11	382	208	2,936	....	3,526	164	36	960	....	1,160
30	24 2	261	182	1,488	....	1,931	240	77	896	....	1,213
Total.	....	7,883	3,134	51,606	....	62,623	3,378	998	13,786	....	18,162
July 1	23 10	315	266	1,266	....	1,847	168	62	544	....	774
2	23 6	254	294	736	....	1,284	266	59	656	....	981
3	23 1	474	331	984	....	1,789	228	62	672	....	962
4	22 7	417	304	1,248	....	1,969	240	35	768	....	1,043
5	22 1	514	280	960	....	1,754	228	37	736	....	1,001
7	20 11	459	225	1,003	....	1,687	134	70	238	....	442
8	20 4	484	169	882	....	1,535	92	61	200	....	353
9	19 10	330	130	580	....	1,040	64	30	160	....	254
10	19 2	307	109	561	....	977	52	25	112	....	189
11	18 9	261	103	485	....	849	90	17	64	....	171
12	18 4	126	49	245	....	420	92	20	88	....	200
14	17 4	32	15	99	....	146	126	32	48	....	206
15	17 0	8	2	46	....	56	124	50	96	....	270
Total.	....	3,981	2,277	9,095	....	15,353	1,904	560	4,382	....	6,846
Grand total.	....	14,355	5,652	64,067	....	84,074	6,266	1,629	19,152	....	27,047

Statement of the daily catch of salmon in two wheels, etc.—Continued.

Date.	Height of water.		Oregon.					Washington.				
			Small chinooks.	Large chinooks	Blue-backs.	Steel-heads.	Total.	Small chinooks.	Large chinooks.	Blue-backs.	Steel-heads.	Total.
1885.	*Ft.*	*in.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
May 11	16	6	12	....	191	....	203	19	2	56	....	77
12	16	6	9	1	136	....	146	40	5	124	....	169
13	16	7	7	2	144	....	153	24	3	84	....	111
14	16	9	12	....	96	....	108	28	2	88	....	118
15	17	4	11	1	168	....	180	23	2	64	....	89
16	18	1	36	4	376	....	416	16	2	56	....	74
18	18	9	70	9	344	....	423	33	3	76	....	112
19	18	9	28	6	216	....	250	17	2	44	....	63
20	18	8	119	16	432	....	567	38	5	116	....	159
21	18	6	155	23	624	....	802	98	12	152	....	262
22	18	7	106	28	656	....	790	92	18	144	....	254
23	18	9	122	18	480	....	620	72	24	108	....	204
25	18	7	40	6	128	....	174	100	24	104	....	228
26	18	3	56	9	136	....	201	112	14	184	....	310
27	17	11	8	1	76	....	85	68	12	260	....	340
28	17	8	4	....	64	....	68	37	9	152	....	198
29	17	5	4	....	32	....	36	44	6	124	....	174
30	17	3	2	2	72	....	76	64	7	108	....	179
Total	....		801	126	4,371	....	5,298	2,044	152	925	....	3,121
June 1	17	2	12	1	80	....	93	60	12	136	....	208
2	17	4	32	3	120	....	155	74	33	128	....	235
3	18	2	64	23	296	....	383	73	32	132	....	237
4	18	8	108	30	352	....	490	51	26	116	....	193
5	19	0	60	37	248	....	345	42	32	176	....	250
6	19	0	334	37	400	....	771	88	49	248	....	385
8	19	4	48	13	560	....	621	32	20	232	....	284
9	19	1	68	32	712	....	812	36	38	252	....	326
10	18	10	116	52	736	....	904	48	71	280	....	399
11	18	6	71	50	928	....	1,049	46	41	216	....	303
12	18	5	72	40	1,148	....	1,260	80	66	240	....	386
13	18	6	101	25	1,432	....	1,558	68	95	360	....	523
15	19	6	72	106	556	....	734	56	66	632	....	754
16	19	8	32	170	1,509	....	1,711	28	33	600	....	661
17	19	10	20	36	630	....	686	12	9	424	....	445
18	19	11	32	46	392	....	470	28	25	640	....	693
19	20	0	92	77	1,172	....	1,341	32	19	472	....	523
20	20	2	184	201	1,713	....	2,098	30	39	576	....	645
22	20	6	143	139	1,805	....	2,087	64	68	1,236	....	1,368
23	20	8	208	135	2,863	....	3,206	116	92	1,344	....	1,552
24	20	8	149	122	2,438	....	2,709	52	22	968	....	1,042
25	20	6	126	106	1,927	....	2,159	56	46	918	....	1,020
26	20	4	192	86	2,233	....	2,511	52	28	1,024	....	1,104
27	20	3	184	63	2,123	....	2,370	92	41	1,520	....	1,653
29	20	0	120	48	662	....	830	78	44	696	....	818
30	19	10	148	67	1,118	....	1,403	84	44	928	....	1,056
Total	....		2,788	1,745	28,223	....	32,756	1,478	1,091	14,494	....	17,063
July 1	19	8	112	32	835	....	979	88	41	608	....	737
2	19	7	132	55	1,008	....	1,195	98	42	448	....	588
3	19	5	124	76	686	....	886	40	18	472	....	530
4	19	3	108	86	637	....	831	20	7	608	....	635
6	18	9	84	48	768	....	900	32	16	456	....	504
7	18	4	72	75	811	....	958	40	20	608	....	668
8	18	2	51	34	748	....	833	22	20	352	....	394
9	17	9	32	16	534	....	582	32	15	436	....	483
10	17	3	24	16	344	....	384	29	6	392	....	427
11	16	10	16	6	236	....	258	32	7	208	....	247
Total	....		755	444	6,607	....	7,806	433	192	4 588	....	5,213
Grand total	....		4,344	2,315	39,201	....	45,860	3,955	1,435	20,007	....	25,397
1886.												
May 12	12	4	....	....	....	....	....	12	....	53	....	65
13	12	8	....	....	....	....	....	8	....	40	....	48
14	12	9	....	....	....	....	....	8	....	24	....	32
15	12	6	....	....	....	....	....	8	....	12	....	20
20	13	0	....	....	....	....	....	4	2	15	....	21
21	14	2	....	....	....	....	....	20	2	69	....	91
22	16	2	....	....	....	....	....	16	4	64	....	84
24	18	6	16	3	167	....	186	4	1	88	....	93
25	18	11	12	4	145	....	161	16	....	24	....	40
26	19	5	12	2	183	....	197	50	4	111	....	165
27	20	6	16	....	128	....	144	40	2	51	....	93
28	21	6	28	5	199	....	232	28	3	95	....	126
29	22	9	28	6	326	....	360	16	2	40	....	58
31	23	11	20	4	303	....	327	4	....	24	....	28
Total	....		132	24	1,451	....	1,607	234	20	710	....	964

Statement of the daily catch of salmon in two wheels, etc.—Continued.

Date.	Height of water.	Oregon.					Washington.				
		Small chinooks.	Large chinooks.	Blue-backs.	Steel-heads.	Total.	Small chinooks.	Large chinooks.	Blue-backs.	Steel-heads.	Total.
1886.	*Ft. in.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
June 1	24 4	52	16	546	....	614	20	12	44	....	76
2	24 6	88	25	450	....	563	47	10	96	....	153
3	24 11	116	44	583	....	743	70	18	152	....	240
4	25 3	152	72	578	....	802	138	34	216	....	388
5	25 6	300	114	635	....	1,049	126	34	216	....	376
7	26 0	192	77	899	....	1,168	60	14	192	....	266
8	26 6	116	60	671	....	847	44	14	280	....	338
9	26 9	196	72	1,437	....	1,705	48	35	144	....	227
10	26 9	248	100	2,191	....	2,539	136	71	866	....	1,073
11	26 8	240	103	2,844	....	3,187	56	22	480	....	558
12	26 6	156	62	2,284	....	2,502	52	24	572	....	648
14	26 0	145	64	2,749	....	2,958	80	25	1,312	....	1,417
15	25 4	212	130	4,819	....	5,161	72	45	1,536	....	1,653
16	24 11	204	129	6,359	....	6,692	116	38	2,304	....	2,458
17	24 6	330	138	7,644	....	8,112	....	....	....	....	....
18	24 0	260	110	8,444	....	8,814	....	....	....	....	....
19	23 6	214	68	8,851	....	9,133	....	....	....	....	....
21	22 8	177	82	7,775	....	8,034	116	51	1,972	....	2,139
22	22 3	316	138	7,946	....	8,400	92	48	1,848	....	1,988
23	21 10	408	200	5,437	....	6,045	84	33	1,508	....	1,625
24	21 6	440	168	4,117	....	4,725	126	113	888	....	1,127
25	21 3	342	132	4,826	....	5,300	106	73	1,432	....	1,611
26	20 0	476	144	4,128	....	4,748	88	56	732	....	876
28	20 6	188	34	2,162	....	2,384	80	50	1,008	....	1,138
29	20 2	224	62	2,257	....	2,543	88	59	912	....	1,059
30	20 0	346	130	1,602	....	2,078	52	39	456	....	547
Total	....	6,138	2,474	92,234	....	100,846	1,897	918	19,166	....	21,981
July 1	19 11	232	100	927	....	1,259	76	49	512	....	637
2	19 9	284	72	837	....	1,193	92	57	778	....	927
3	19 5	228	66	547	....	841	82	35	696	....	813
5	18 11	60	26	253	....	339	24	13	216	....	253
6	18 9	4	6	187	....	197	44	19	456	....	519
7	18 4	20	9	221	....	250	4	2	312	....	318
8	18 2	48	6	171	....	225	32	6	272	....	310
9	17 9	12	17	125	....	154	25	6	216	....	247
10	17 3	....	....	....	....	....	20	2	136	....	158
12	16 5	....	....	....	....	....	8	5	40	....	53
13	16 2	....	....	....	....	....	12	1	40	....	53
Total	....	888	302	3,268	....	4,458	419	195	3,674	....	4,288
Grand total	....	7,158	2,800	96,953	....	106,911	2,550	1,133	23,550	....	27,233
1887.											
May 2	15 8	....	....	178	....	178	....	....	....	....	....
3	16 5	....	....	78	....	78	....	....	54	....	54
4	16 6	....	....	....	....	....	....	....	72	....	72
5	16 5	....	....	....	....	....	3	....	26	....	29
7	16 6	....	....	....	....	....	10	....	64	....	74
9	16 11	....	....	....	....	....	108	....	150	....	258
10	17 0	20	....	278	....	298	73	....	116	....	189
11	16 9	12	....	102	....	114	38	1	58	....	97
12	16 5	....	....	....	....	....	80	1	76	....	157
13	16 6	24	....	80	....	104	168	....	136	....	304
14	16 5	72	2	64	....	138	250	2	176	....	428
16	15 8	....	....	....	....	....	518	2	200	....	720
17	15 5	....	....	....	....	....	116	1	120	....	237
18	15 6	....	....	....	....	....	116	2	232	....	350
19	16 0	....	....	....	....	....	184	2	272	....	458
20	17 2	68	2	56	....	126	208	2	416	....	626
21	18 10	208	12	487	....	707	158	7	112	....	277
23	21 0	52	8	222	....	282	4	....	88	....	92
24	21 5	68	10	184	....	262	20	1	48	....	69
25	21 6	83	10	213	....	306	44	6	72	....	122
26	21 10	120	14	236	....	370	40	2	40	....	82
27	22 11	111	20	159	....	290	24	2	40	....	66
28	23 11	48	4	246	....	298	12	....	24	....	36
30	25 11	24	5	64	....	93	8	....	12	....	20
31	27 3	12	2	24	....	38	4	....	8	....	12
Total	....	922	89	2,671	....	3,682	2,186	31	2,612	....	4,820

Statement of the daily catch of salmon in two wheels, etc.—Continued.

Date.	Height of water.	Oregon.					Washington.				
		Small chinooks.	Large chinooks.	Blue-backs.	Steel-heads.	Total.	Small chinooks.	Large chinooks.	Blue-backs.	Steel-heads.	Total.
1887.	*Ft. in.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
June 1	28 10	....	1	56	....	57	....	....	....	....	....
6	30 7	6	....	42	....	48	2	....	16	....	18
7	30 2	24	4	119	....	147	10	1	32	....	43
8	29 7	72	7	303	....	382	20	4	64	....	88
9	29 2	100	26	536	....	662	48	7	152	....	207
10	28 9	223	32	768	....	1,023	43	12	112	....	167
11	28 6	412	65	999	....	1,476	172	36	224	....	432
13	28 9	470	113	829	....	1,412	88	26	136	....	250
14	29 1	224	62	696	....	982	....	....	....	....	....
15	29 4	440	87	1,436	....	1,963	64	11	280	....	355
16	29 8	296	86	1,456	....	1,838	42	30	408	....	480
17	30 2	348	129	1,948	....	2,425	64	34	408	....	506
18	31 11	84	34	600	....	718	2	3	24	....	29
20	32 10	....	4	56	....	60	....	....	58	....	58
21	32 4	20	4	1,472	....	1,496	....	....	....	....	....
22	32 2	48	40	2,536	....	2,624	....	....	....	....	....
23	32 1	104	74	2,022	....	2,200	84	32	672	....	788
24	32 1	192	116	2,069	....	2,377	36	23	448	....	507
25	32 5	208	164	2,114	....	2,486	80	37	920	....	1,037
27	32 6	191	94	2,484	....	2,769	12	10	256	....	278
28	32 0	175	79	3,384	....	3,638	36	4	280	....	320
29	31 7	300	190	3,216	....	3,706	80	35	632	....	747
30	30 10	460	274	3,743	....	4,477	70	55	528	....	653
Total.	....	4,397	1,685	32,884	....	38,966	953	360	5,660	....	6,973
July 1	30 2	464	196	4,215	....	4,875	143	109	648	....	900
2	29 6	428	186	4,272	....	4,886	120	76	584	....	780
4	29 0	312	98	3,196	....	3,606	76	74	408	....	558
5	28 10	332	119	3,628	....	4,079	136	100	312	....	548
6	28 8	314	100	2,640	....	3,054	110	84	240	....	434
7	28 5	348	110	2,177	....	2,635	112	67	344	....	523
8	28 2	264	108	1,498	....	1,870	96	81	496	....	673
9	28 1	228	83	1,028	....	1,339	126	83	328	76	613
10	27 10	....	....	....	....	....	64	22	264	84	434
11	27 8	208	36	632	....	876	98	25	296	132	551
12	27 4	164	30	577	....	771	72	10	224	108	414
13	26 9	60	20	224	....	304	56	34	176	128	394
14	26 3	152	26	640	....	818	56	17	112	144	329
15	25 9	116	16	568	....	700	72	14	296	168	550
16	25 1	80	12	480	....	572	60	8	256	200	524
18	23 10	108	54	784	....	946	100	41	296	424	861
19	23 2	72	30	264	....	366	28	11	72	76	187
20	22 8	272	65	224	....	561	18	20	64	132	234
21	21 11	344	76	216	....	636	32	28	108	484	652
22	21 6	516	98	496	....	1,110	8	12	16	128	164
23	21 1	380	136	536	....	1,052	48	30	24	360	462
25	20 3	276	52	384	....	712	78	72	....	944	1,094
26	19 11	212	26	320	....	558	37	20	....	400	457
27	19 6	144	30	352	....	526	36	16	....	346	398
28	19 2	220	44	464	....	728	38	28	....	272	338
29	18 11	212	54	480	....	746	28	21	....	264	313
30	18 8	204	36	480	....	720	38	11	....	252	301
Total.	....	6,430	1,841	30,775	....	39,046	1,886	1,114	5,564	5,122	13.686
Aug. 1	18 0	....	....	....	....	....	62	28	....	234	324
Grand total.	....	11,749	3,615	66,330	....	81,694	5,087	1,533	13,836	5,356	25,812
1888. Apr. 26	12 1	....	....	....	....	....	....	....	44	....	44
27	13 1	....	....	....	....	....	....	....	68	....	68
28	13 2	....	....	....	....	....	....	....	56	....	56
30	12 10	....	....	....	....	....	12	....	19	....	31
Total.	....	....	....	....	....	....	12	....	187	....	199
May 1	12 7	....	....	....	....	....	17	....	24	....	41
2	12 6	....	....	....	....	....	28	1	56	....	85
3	12 9	....	....	....	....	....	44	....	80	....	124
4	13 6	....	....	....	....	....	54	....	132	....	186
5	13 11	....	....	....	....	....	20	....	40	....	60
7	14 4	....	....	....	....	....	80	1	64	....	145
8	14 9	....	....	....	....	....	60	4	2	....	66
9	15 0	....	....	....	....	....	20	....	32	....	52

Statement of the daily catch of salmon in two wheels, etc.—Continued.

Date.	Height of water.		Oregon.					Washington.				
			Small chinooks.	Large chinooks.	Blue-backs.	Steel-heads.	Total.	Small chinooks.	Large chinooks.	Blue-backs.	Steel-heads.	Total.
1888.	*Ft.*	*in.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
May 10	15	3	16	2	72	....	90	48	1	56	....	105
11	15	9	26	....	104	....	130	36	2	40	....	78
12	16	2	68	4	440	....	512	32	....	48	....	80
14	16	2	84	....	112	....	196	53	2	96	....	151
15	15	10	28	2	144	....	174	62	....	24	....	86
16	16	0	44	2	96	....	142	73	3	24	....	100
17	16	5	96	4	180	....	280	84	8	68	....	160
18	17	1	36	4	32	....	72	72	9	88	....	169
19	17	9	64	12	216	....	292	80	10	120	....	210
21	17	6	64	4	184	....	252	64	14	16	....	94
22	17	4	48	8	168	....	224	76	4	64	....	144
23	17	1	80	6	168	....	254	44	....	24	....	68
24	17	0	100	4	112	....	216	165	12	90	....	267
25	16	8	64	4	104	....	172	96	5	64	....	165
26	16	5	16	....	48	....	64	64	....	48	....	112
28	16	3	28	2	64	....	94	64	1	84	....	149
29	16	4	34	2	176	....	212	51	2	48	....	101
30	16	9	40	18	152	....	210	28	3	16	....	47
31	17	3	32	6	248	....	286	17	....	13	....	30
Total	....		968	84	2,820	....	3,872	1,532	82	1,461	....	3,075
June 1	17	9	48	20	272	....	340	28	6	48	....	82
2	18	5	76	32	440	....	548	38	5	96	....	139
4	19	7	56	34	284	....	374	9	....	64	....	73
5	20	3	36	20	216	....	272	6	....	104	....	110
6	20	9	60	30	304	....	394	11	2	216	....	229
7	21	4	36	18	176	....	230	6	2	308	....	316
8	21	9	28	24	168	....	220	15	9	216	....	240
9	22	1	24	12	360	....	396	14	2	216	....	232
11	22	7	36	70	360	....	466	10	....	144	....	154
12	22	9	172	120	552	....	844	17	7	172	....	196
13	22	10	108	70	328	....	506	65	29	608	....	700
14	22	11	136	70	752	....	958	13	4	384	....	401
15	23	10	28	28	120	....	176	11	5	368	....	384
16	23	3	24	4	264	....	292	2	1	192	....	195
18	23	6	64	52	368	....	484	15	3	176	11	205
19	23	7	96	112	672	....	880	20	10	224	11	265
20	23	6	224	174	632	....	1,030	62	20	304	....	386
21	23	4	308	210	992	....	1,510	56	23	496	16	591
22	23	1	238	117	1,562	....	1,917	48	26	702	30	806
23	22	11	320	100	1,574	....	1,994	55	28	1,144	53	1,280
25	22	1	164	34	1,336	....	1,534	52	21	592	48	713
26	21	7	240	26	2,360	....	2,626	90	26	856	124	1,096
27	21	3	280	38	2,368	....	2,686	88	19	992	292	1,391
28	20	10	228	26	1,600	....	1,854	86	25	704	404	1,219
29	20	7	384	24	1,472	....	1,880	64	24	556	512	1,156
30	20	4	384	20	968	....	1,372	108	26	632	680	1,446
Total	....		3,798	1,485	20,500	....	25,783	989	321	10,514	2,181	14,005
July 2	19	7	304	8	432	....	744	20	2	136	392	550
3	19	3	348	14	536	....	898	53	10	280	616	959
4	18	10	316	12	704	....	1,032	50	15	344	488	897
5	18	7	272	8	512	....	792	44	9	368	392	813
6	18	5	288	10	416	....	714	48	14	240	344	646
7	18	1	152	6	308	....	466	40	11	176	296	523
9	17	5	304	4	344	....	652	12	3	56	196	267
10	17	1	164	2	232	....	398	10	1	32	184	227
11	16	7	4	....	48	....	52	18	1	48	236	303
12	16	3	104	6	192	....	302	6	1	24	220	251
13	15	10	....	....	....	....	....	8	1	16	250	275
14	15	6	....	....	....	....	....	4	....	16	112	132
16	14	10	....	....	....	....	....	4	1	8	56	69
17	14	6	....	....	....	....	....	4	....	8	52	64
18	14	4	....	....	....	....	....	8	....	8	24	40
19	14	4	....	....	....	....	....	1	....	6	14	21
20	14	1	....	....	....	....	....	....	....	....	28	28
21	13	10	....	....	....	....	....	....	....	6	24	30
Total	....		2,256	70	3,724	....	6,050	330	69	1,772	3,924	6,095
Grand total	....		7,022	1,639	27,044	....	35,705	2,863	472	13,934	6,105	23,374

Statement of the daily catch of salmon in two wheels, etc.—Continued.

Date.	Height of water.		Oregon.					Washington.				
			Small chinooks.	Large chinooks.	Blue-backs.	Steel-heads.	Total.	Small chinooks.	Large chinooks.	Blue-backs.	Steel-heads.	Total.
1890.	*Ft.*	*in.*	*Number*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
Apr. 30	12	10	....	....	....	....	....	....	....	88	1	89
May 1	14	1	....	....	....	....	....	2	....	24	2	28
2	15	5	....	1	56	....	57	7	....	69	1	77
3	16	8	....	....	208	....	208	14	6	72	....	92
5	19	3	20	4	312	....	336	15	2	64	....	81
6	20	0	24	2	272	....	298	24	1	60	....	85
7	20	8	20	2	96	....	118	20	2	45	1	68
8	21	4	32	2	80	....	174	36	4	27	....	67
9	22	1	68	12	156	....	236	8	1	19	....	28
10	23	2	28	2	14	....	174	4	....	20	....	24
12	24	9	24	....	48	....	72	7	1	21	....	29
13	25	0	20	4	48	....	72	4	....	8	2	14
14	25	6	44	6	88	....	138	22	1	16	....	39
15	25	7	64	4	56	....	124	28	3	16	....	47
16	25	7	64	22	72	....	158	47	6	21	....	74
17	25	6	120	28	136	....	284	128	26	58	....	212
19	25	6	408	166	328	....	902	318	104	144	....	566
20	25	10	193	226	984	....	1,403	244	80	152	2	478
21	25	10	664	266	640	....	1,570	364	150	152	....	666
22	25	7	850	549	....	....	1,399	246	93	32	....	371
26	24	6	556	124	1,344	....	2,024	444	67	776	....	1,287
27	24	4	756	188	1,280	....	2,479	356	64	600	....	1,020
28	24	3	916	251	1,312	....	2,224	494	104	680	....	1,278
29	24	3	464	182	376	....	1,022	540	86	480	....	1,106
30	24	1	388	182	152	....	722	292	57	120	....	469
31	23	10	370	115	152	....	637	308	70	160	....	538
Total.	....		6,093	2,338	8,340	....	16,771	3,972	928	3,836	8	8,744
June 2	22	6	254	133	264	....	651	120	28	48	....	196
3	21	10	292	74	360	....	726	190	66	136	4	396
4	21	6	292	96	280	....	668	248	82	208	4	542
5	21	1	280	119	344	....	743	234	103	240	4	581
6	20	7	232	64	472	....	768	154	62	256	16	488
7	20	2	180	60	552	9	801	236	144	624	8	1,012
9	19	6	116	33	392	4	545	156	46	448	10	660
10	19	5	144	58	488	8	698	148	77	688	20	933
11	19	7	128	32	664	20	844	228	104	776	31	1,139
12	19	9	136	72	696	17	921	208	134	808	36	1,186
13	19	10	140	106	992	23	1,261	151	88	760	32	1,031
14	19	8	127	106	1,080	32	1,345	178	126	960	36	1,300
16	19	5	74	76	2,232	24	2,406	141	96	1,728	60	2,025
17	19	1	96	42	2,888	20	3,046	116	50	2,952	44	3,162
18	19	0	44	16	2,852	8	2,920	92	47	2,728	52	2,919
19	18	10	68	11	2,432	16	2,527	92	47	2,618	64	2,821
20	18	8	....	....	288	12	300	8	....	136	8	152
21	18	7	120	28	2,960	32	3,140	84	74	2,232	119	2,509
23	18	3	64	14	2,296	76	2,450	80	29	1,280	180	1,569
24	18	0	32	6	1,336	48	1,422	96	45	1,160	228	1,529
25	17	9	44	4	1,296	76	1,420	60	12	1,136	208	1,416
26	17	7	44	8	1,208	76	1,336	36	7	952	133	1,128
27	17	5	52	10	1,088	88	1,238	44	23	1,120	176	1,363
28	17	6	68	22	1,048	124	1,262	28	20	728	216	992
30	17	7	34	13	856	92	995	60	17	584	260	921
Total.	....		3,061	1,203	29,364	805	34,433	3,188	1,527	25,306	1,949	31,970
July 1	17	5	72	14	1,048	116	1,250	48	19	592	280	939
2	17	2	32	10	776	112	930	46	10	416	256	728
3	17	1	20	10	496	136	662	56	26	280	408	770
4	16	11	28	10	376	208	622	24	27	544	648	1,243
5	17	0	32	8	464	240	744	32	8	312	504	856
7	16	11	20	4	192	128	344	16	2	160	196	374
8	16	10	32	2	360	132	526	12	5	152	292	461
9	16	8	24	4	288	80	396	12	6	160	224	402
10	16	8	12	2	120	40	174	12	6	172	272	462
11	16	7	12	16	80	40	148	18	7	80	236	341
12	16	4	8	2	88	25	125	12	7	56	160	235
14	15	10	8	....	32	8	48	8	1	51	88	148
15	15	6	....	....	....	....	....	16	3	16	122	157
16	15	4	....	....	....	....	....	4	....	40	96	140
17	14	10	....	....	....	....	....	4	2	60	104	170
18	14	7	....	....	....	....	....	4	....	24	84	112
19	14	3	....	....	....	....	....	12	4	32	64	112
21	13	8	....	....	....	....	....	....	....	5	16	21
22	13	4	....	....	....	....	....	....	....	7	12	19
23	12	11	....	....	....	....	....	....	....	6	4	10
Total.	....		300	82	4,320	1,265	5.967	336	133	3,165	4,066	7,700
Grand total.	....		9,454	3,623	42,024	2,070	57,171	7,496	2,588	32,395	6,024	48,503

Statement of the daily catch of salmon in two wheels, etc.—Continued.

Date.	Height of water.		Oregon.					Washington.				
			Small chinooks.	Large chinooks.	Blue-backs.	Steel-heads.	Total.	Small chinooks.	Large chinooks.	Blue-backs.	Steel-heads.	Total.
1891.	*Ft.*	*in.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
May 11	14	5						2	1	3		6
12	14	3						4		5		9
13	14	0						5		6		11
14	13	10						8		12		20
15	14	1						8		8	1	17
16	14	7						27	1	18	1	47
18	16	3	33	6	56		95	24	4	16		44
19	17	2	11	6	28		45	56	5	40		101
20	18	0	25	7	74		106	27	6	39		72
21	18	4	14	4	61	1	80	18	4	32	1	55
22	18	4	9	2	74		85	20	4	32		56
23	18	1	16	4	67		87	65	10	76		151
25	17	8	37	8	124	1	170	54	9	79	1	143
26	17	6	63	11	112		186	54	7	104	2	167
27	17	10	76	16	161	4	257	64	16	120		200
28	18	3	24	9	119		152	26	14	48		88
29	18	7	24	17	163		204	7	5	32	3	47
30	19	0	20	24	128	1	173	35	16	85		136
Total			352	114	1,167	7	1,640	504	102	755	9	1,370
June 1	19	4	21	14	125	1	161	16	6	76	1	99
2	19	5	39	17	116		172	91	12	134	1	238
3	19	5	35	26	188		249	66	12	144	2	224
4	19	4	52	21	216	2	291	58	28	184	2	272
5	19	4	62	38	276	1	377	86	33	88	2	209
6	19	4	47	29	248		324	35	13	40		88
8	19	5	27	20	74	4	125	60	30	52		142
9	19	4	42	24	144		210	32	16	72		120
10	19	2	36	20	178	1	235	42	11	72	5	130
11	19	0	40	16	160	2	218	43	13	40	3	99
12	18	7	36	10	140	2	188	42	21	80	2	145
13	18	6	54	32	168	2	256	68	47	118	6	239
15	18	0	53	24	176	7	260	51	26	92	6	175
16	18	1	29	17	152	5	203	33	31	144	5	213
17	18	5	44	32	131	2	209	43	40	153	8	244
18	18	4	27	22	164	5	218	15	15	173	9	212
19	18	1	8	12	120	6	146	6	5	178	3	192
20	18	1	12	12	115	9	148	10	1	164	8	183
22	18	5	15	6	145	9	175	15	8	107	6	136
23	18	7	20	34	128	10	192	20	16	100	12	148
24	18	7	20	19	104	13	156	14	25	145		184
25	18	4	18	14	206	20	258	12	13	151	14	190
26	18	5	36	25	232	12	305	23	14	252	22	311
27	18	2	48	38	264	10	360	52	42	257	38	389
29	17	8	35	3	137	13	188	22	5	118	36	181
30	17	5	20	6	176	14	216	21	12	166	33	232
Total			876	531	4,283	150	5,840	976	495	3,300	224	4,995
July 1	17	0	24	2	178	16	220	11	2	146	34	193
2	16	8	16	4	56	9	85	15	1	103	40	159
3	16	4	8	4	72	5	89	7		127	45	179
4	16	0			11	2	13	8	2	79	77	166
6	15	6						4		8	67	79
7	15	5						5		25	176	206
8	15	1								21	157	178
9	14	11						2		15	68	85
10	14	9						4		15	53	72
11	14	8						1		23	65	89
13	14	8						3		4	27	34
14	14	6								10	44	54
15	14	4								8	87	95
16	14	3						2	2	12	80	96
17	13	10						6	1	0	20	27
18	13	5						2		11	50	63
20	13	0						1		3	11	15
21	12	10								6	13	19
22	12	7								3	4	7
23	12	6						2		2	8	12
24	12	4								2	4	6
25	12	5									5	5
27	12	4								3		3
Total			48	10	317	32	407	73	8	626	1,135	1,842
Grand total			1,276	655	5,767	189	7,887	1,553	605	4,681	1,368	8,207

Statement of the daily catch of salmon in two wheels, etc.—Continued.

Date.	Height of water.		Oregon. Small chinooks.	Oregon. Large chinooks.	Oregon. Blue-backs.	Oregon. Steel-heads.	Oregon. Total.	Washington. Small chinooks.	Washington. Large chinooks.	Washington. Blue-backs.	Washington. Steel-heads.	Washington. Total.
1892.	*Ft.*	*in.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
May 14	11	7			40		40			19		19
16	12	3			67		67			84		84
17	12	5			151		151			128		128
18	12	8	2		248		250			176		176
19	13	0			320		320			99		99
20	13	7	8	1	696		705	4	1	144		148
21	14	5	8	5	1,328		1,341	4		360		364
23	15	10	48	3	304		355	18	2	128		148
24	16	11	52	12	496		560	8	3	80	1	92
25	18	6	30	4	336		370	3		40		43
26	20	0	24	8	312		334	2	1	64		67
27	20	9	4		40		44	2		112		114
28	21	7	1	1	96		97			160		160
30	22	11	8		56		64		2	40		42
31	23	9	4	2	56		62	7	1	33		41
Total			189	35	4,536		4,760	48	9	1,667	1	1,725
June 1	24	2	4	2	32		38	3	1	37	2	43
2	23	10	8	4	152		164	12	4	39		55
3	23	5	36	8	224		268	28	7	64		99
4	23	0	44	11	215		270	26		184	1	211
6	22	3	192	49	256		497	32	5	128		165
7	21	10	160	50	88		298	20	4	48		72
8	21	8	214	74	114		402	28	5	104	3	140
9	21	9	216	58	109		383	112	12	248	4	376
10	22	0	188	62	40	2	292	52	23	112	8	195
11	22	3	136	61	118		315	40	13	248	6	307
13	22	2	180	51	48	5	284	98	20	168	6	292
14	22	8	370	132	152	2	656	76	32	136	8	252
15	22	7	272	90	96	4	462	72	25	168	6	271
16	23	0	236	106	24	7	373	56	18	72		146
17	23	6	220	82	96	23	421	86	38	80	12	216
18	23	11	232	98	72	8	410	91	36	144	35	306
20	24	9	124	52	64	13	253	64	18	128	11	221
21	25	1	36	26	56	17	135	24	8	168	24	224
22	25	5	45	14	88	13	160	34	8	72	28	142
23	25	6	40	16	64	11	131	36	10	120	20	186
24	25	5	48	26	64	4	142	52	6	128	32	218
25	25	2	136	56	272	36	500	95	57	390	34	576
27	24	5	270	126	832	68	1,296	85	65	504	36	690
28	24	3	234	176	840	44	1,294	96	87	984	72	1,239
29	24	4	280	184	832	196	1,492	66	86	768	109	1,029
30	24	5	204	110	360	148	822	52	35	784	114	985
Total.			4,125	1,724	5,308	601	11,758	1,436	623	6,026	571	8,656
July 1	24	7	216	118	268	224	826	55	41	616	180	892
2	24	9	32	20	32	44	128	38	20	424	180	662
4	24	9	108	58	216	200	582	66	33	336	298	733
5	24	8	124	96	120	184	524	70	51	344	248	713
6	24	6	116	82	136	216	550	59	25	264	208	556
7	24	4	60	47	96	168	371	32	12	144	187	375
8	24	2	72	46	204	197	519	25	11	224	235	495
9	23	10	128	78	136	316	658	52	50	232	228	562
11	23	2	52	90	98	320	560	20	21	80	200	321
12	22	7	84	102	96	308	590	4	8	32	64	108
13	22	2	53	110	64	288	515	12	23	72	288	395
14	21	8	76	58	71	300	505	4	14	64	452	534
15	21	3	52	126	40	380	598	16	77	16	522	631
16	20	8	32	144	32	376	584	8	59	26	676	769
18	19	7	56	62	9	420	547	20	23	5	568	616
19	18	11	60	52	16	420	548	16	24		448	488
20	18	5	44	60	14	384	502	16	31	15	528	590
21	17	11	14	36	8	196	254	8	3	6	324	341
22	17	5	40	46	5	356	447	10	7		292	309
23	16	11	52	32	13	291	388	12	5		230	247
25	16	2	32	20	2	96	150	20	3		220	243
26	15	7	43	21		72	136	12	3		148	163
27	15	2	36	26	2	70	134	5	2		72	79
28	14	8	28	14		48	90				28	28
29	14	3	24	6	3	32	65			8	58	66
30	13	10	28	6	2	19	55	8	7		50	65
Total.			1,662	1,556	1.683	5,925	10,826	588	553	2,906	6,932	10.981
Aug. 1	13	2	8	1	2	7	18	5			11	16
2	12	9	4		3	24	31					
3	12	4	6		1	2	9					
Total.			18	1	6	33	58	5			11	16
Grand Total..			5,994	3,316	11,533	6,559	27,402	2,077	1,185	10,601	7,515	21,378

Statement of the daily catch of salmon in two wheels, etc.—Continued.

Date.	Height of water.	Oregon.					Washington.				
		Small chinooks.	Large chinooks.	Blue-backs.	Steel-heads.	Total.	Small chinooks.	Large chinooks.	Blue-backs.	Steel-heads.	Total.
1893.	*Ft. in.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
Apr. 27	10 6	....	....	....	....	....	8	....	12	1	21
May 1	12 6	1	....	14	....	15	5	2	10	1	18
2	12 8	2	....	15	....	17	19	10	3	4	36
3	13 1	3	1	16	....	20	6	3	28	....	37
4	13 4	1	....	24	....	25					
5	13 8	2	1	26	....	29	....	....	....	....	....
6	14 1	2	....	36	....	38	....	....	....	....	....
8	14 5	2	1	35	....	38	7	2	23	1	33
9	14 9	3	1	31	....	35	9	2	25	3	39
10	15 4	10	6	13	....	29	21	3	52	....	76
11	16 4	4	5	31	....	40	....	....	16	1	17
12	17 5	2	1	18	....	21	1	....	7	....	8
13	18 4	3	6	46	....	55	1	1	11	....	13
15	19 7	9	4	36	....	49	1	2	10	....	13
16	20 6	19	11	39	....	69	8	1	13	....	22
17	21 7	12	17	40	1	70	11	1	35	....	47
18	22 7	5	9	3	....	17	2	....	3	4	9
19	24 0	3	....	7	....	10	....	....	....	....	....
20	25 8	....	1	2	2	5	....	....	....	....	....
22	26 2	3	....	11	....	14	5	....	16	....	21
23	26 0	3	....	24	....	27	....	....	....	....	....
24	25 8	2	1	21	....	24	5	5	35	....	45
25	25 3	6	2	56	....	64	27	7	46	1	81
26	25 0	17	10	40	3	70	58	8	86	1	153
27	24 9	52	23	80	....	155	149	32	160	4	345
29	24 0	144	50	112	....	306	74	6	50	3	133
30	24 0	110	52	73	....	235	113	15	116	6	250
31	23 11	140	31	88	4	263	60	12	101	....	173
Total	....	560	233	937	10	1,740	582	112	846	29	1,569
June 1	24 6	162	28	126	....	316	76	16	141	6	239
2	24 7	166	46	96	1	309	136	34	246	3	419
3	24 10	240	95	68	2	405	90	32	308	2	432
5	24 10	322	72	59	9	462	71	14	52	6	143
6	24 6	264	75	80	....	419	124	40	168	....	332
7	24 11	184	62	368	6	620	114	38	127	4	283
8	25 1	124	50	144	7	325	97	49	126	6	278
9	25 10	96	26	144	4	270	88	37	94	6	225
10	26 7	72	14	264	4	354	101	48	279	9	437
12	27 3	32	12	138	7	189	17	4	52	5	78
13	27 8	20	5	96	6	127	33	13	106	1	153
14	28 1	16	4	96	4	120	35	6	99	2	142
15	28 2	8	6	80	2	96	10	1	39	1	51
16	27 10	8	3	79	5	95	8	1	36	3	48
17	27 3	28	6	160	6	200	49	19	129	5	202
19	26 5	104	52	80	2	238	108	57	88	3	256
20	26 3	126	72	65	3	266	134	125	173	13	445
21	26 5	148	92	136	7	383	195	180	498	12	885
22	26 0	116	52	96	8	272	84	123	439	16	662
23	25 6	80	45	80	8	213	48	54	309	18	429
24	24 11	60	34	176	12	282	48	46	369	19	482
26	24 1	224	108	264	23	619	149	94	319	16	578
27	23 10	272	172	400	28	872	334	236	1,038	49	1,657
28	23 6	163	96	335	34	628	153	102	1,116	49	1,420
29	23 5	160	88	322	44	614	102	90	1,076	48	1,316
30	23 7	132	66	304	88	590	92	47	832	57	1,028
Total	....	3,327	1,381	4,256	320	9,284	2,496	1,506	8,259	359	12,620
July 1	23 5	120	88	288	111	607	150	59	1,086	140	1,435
3	22 9	84	42	136	132	394	49	23	232	65	369
4	22 4	72	32	208	132	444	113	53	571	89	826
5	22 2	66	43	216	160	485	108	52	884	98	1,142
6	22 3	68	24	198	156	446	78	57	649	118	902
7	22 0	68	16	202	120	406	140	30	399	328	897
8	21 11	56	17	184	204	461	203	70	445	499	1,217
10	21 2	54	18	152	348	572	45	15	75	329	464
11	20 11	34	24	84	351	493	56	33	122	622	833
12	20 10	40	20	92	254	406	56	10	99	499	664
13	21 1	52	24	104	368	548	33	7	72	538	650
14	21 6	76	40	103	360	579	39	16	90	650	795
15	21 7	80	49	72	400	601	31	23	64	951	1,069
17	21 1	28	18	42	189	277	19	16	27	378	440
18	21 0	28	18	56	252	354	34	18	39	462	553
19	20 11	32	14	56	241	343	16	11	2	390	419
20	20 10	24	6	38	247	315	15	5	29	357	406
21	20 10	36	16	35	240	327	20	10	23	408	461
22	20 8	30	19	30	248	327	25	8	26	612	671
24	20 4	27	16	31	188	262	19	11	18	252	300

Statement of the daily catch of salmon in two wheels, etc.—Continued.

Date.	Height of water.		Oregon.					Washington.				
			Small chinooks	Large chinooks.	Blue-backs.	Steel-heads.	Total.	Small chinooks.	Large chinooks.	Blue-backs.	Steel-heads.	Total.
1893.	*Ft.*	*in.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*	*Number.*
July 25	20	2	28	15	23	112	178	36	7	17	290	350
26	20	1	38	18	26	172	254	22	12	29	305	368
27	19	9	36	18	33	140	227	12	10	29	315	366
28	19	6	44	21	29	138	232	35	13	27	221	296
29	19	1	36	9	15	96	156	32	21	26	335	414
31	18	6	28	2	8	134	172	13	11	3	108	135
Total	...		1,285	627	2,461	5,493	9,866	1,399	601	5,083	9,359	16,442
Aug. 1	18	0	40	8	9	63	120	15	6	7	170	198
2	17	8	40	26	3	78	147	28	18	11	167	224
3	17	3	36	9	10	44	99	13	8	7	171	199
4	17	0	44	12	10	25	91	16	5	5	90	116
5	16	8	31	6	8	100	145	21	13	8	121	163
7	16	1	24	5	...	16	45	7	...	1	20	28
8	15	9	28	5	...	6	39	3	1	...	19	23
9	15	5	36	2	...	4	42	6	1	...	19	26
10	15	4	27	2	1	2	32	4	2	...	34	40
11	15	0	4	...	...	...	4	1	...	4	4	9
Total	...		310	75	41	338	764	114	54	43	815	1,026
Grand total	...		5,482	2,316	7,695	6,161	21,654	4,599	2,273	14,243	10,563	31,678
1894.												
April 12	14	5	...	...	...	...	...	1	1	...	4	6
13	16	0	...	...	...	...	...	...	...	...	3	3
14	16	4	...	...	...	...	...	2	...	...	2	4
17	16	3	...	...	...	...	...	...	...	...	2	2
18	15	6	...	...	...	...	...	...	...	...	3	3
20	14	6	2	...	1	...	3	...	1	...	5	6
21	14	5	...	...	...	...	...	...	1	...	4	5
23	14	10	...	2	...	1	3	1	1	...	3	5
24	16	0	...	...	...	...	...	3	1	2	4	10
25	17	4	4	4	3	1	12	4	...	2	...	6
26	19	3	...	...	...	...	...	...	1	1	2	4
27	21	4	1	2	...	...	3	...	...	...	...	...
28	21	0	...	...	...	...	...	2	...	1	...	3
Total	...		7	8	4	2	21	13	6	6	32	57
May 2	21	10	...	...	...	...	...	4	...	1	3	8
3	21	10	1	4	3	2	10	...	...	...	...	...
4	20	5	...	...	...	...	...	19	1	15	1	36
5	20	0	5	2	4	...	11	18	4	29	5	56
7	19	4	13	7	25	8	53	13	2	12	...	27
8	19	10	12	6	24	...	42	14	8	21	...	43
9	20	5	4	15	30	...	49	15	17	20	...	52
10	20	6	4	18	32	...	54	9	2	11	...	22
11	20	8	8	8	56	2	74	13	6	29	2	50
12	20	8	12	10	90	1	113	39	7	68	1	115
14	20	6	16	12	106	2	136	16	5	32	1	54
15	20	11	...	4	5	1	10	27	5	48	1	81
16	21	7	7	4	20	1	32	15	3	48	1	67
17	22	6	1	1	8	3	13	7	3	23	...	33
18	23	1	3	3	10	...	16	3	1	32	...	36
19	23	4	...	1	13	1	15	7	...	37	1	45
21	24	0	...	2	27	...	29	6	4	39	...	49
22	25	9	2	1	4	...	7	5	4	22	...	31
23	26	9	...	...	...	...	...	4	1	16	...	21
24	28	0	2	2	3	2	9	5	1	12	...	18
25	29	3	1	...	10	...	11	4	5	16	...	25
26	30	8	...	...	...	...	...	4	3	38	1	46
Total	...		91	100	470	23	684	247	82	569	17	915
Grand total	...		98	108	474	25	705	260	88	575	49	972

On the salmon industry in 1876.—In the year 1876 Mr. M. J. Kinney, now the most extensive salmon-packer at Astoria, began the canning of salmon at that place. There were then only about 400 gill-net boats on the river, traps and wheels were not employed, and only chinook salmon were utilized for canning. The gill nets were then smaller than those now used, being only 300 fathoms long and 40 meshes deep. The season of 1876

was similar to 1894 in that there was a very heavy freshet, which for a time imperiled the fishery. The run was enormous. With the gear now employed and the factories now operated Mr. Kinney estimates that the output of the Columbia River in 1876 would have been 1,500,000 cases; there were enough fish in the river to pack that quantity.

The pack, as elsewhere given, amounted to 450,000 cases of chinooks, equivalent to over 1,200,000 fish, a larger pack and catch than had been made in any previous year, while in only nine of the subsequent eighteen years were the canning operations more extensive and in only eight were more chinooks packed, notwithstanding the advent of pound nets and wheels and the increase of 50 to 75 per cent in the number of gill nets employed. The boats fishing regularly for Mr. Kinney took an average of 4,300 chinook salmon each during the season. One boat landed 9,194 fish at the cannery, the catch being apportioned as follows among the different months: April, 1,020; May, 1,651; June, 2,631; July, 3,564; August, 328.

The daily catch of the foregoing boat and of ten other boats fishing for Mr. Kinney is shown in the following table. These boats, while representing more than the average production for the lower river, are not selected for this reason, but because of the fact that their operations covered the greater part, if not all, of the fishing season. The aggregate catch of these eleven boats was 55,832 chinook salmon. A similar average catch at the present time would mean an annual pack of over 2,000,000 cases of chinook salmon. These figures are interesting as showing the daily fluctuations in the abundance of fish as well as affording a basis for comparison with other years.

Table showing the daily catch of chinook salmon by eleven gill-net fishermen landing fish at the cannery of Mr. M. J. Kinney, at Astoria, Oreg., in 1876.

Date.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.	No. 8.	No. 9.	No. 10.	No. 11.	Total.
Apr. 15-26	[a] 1,000											1,000
27				15	9							24
28	20			20								40
29				25								25
30												
Total	1,020			60	9							1,089
May 1	82					30	21	31	20			184
2		28	29	18	38	55	13			17	24	222
3	61	42	28	32		61	13		55	26	18	336
4		30	47			53				34	48	212
5	59	30		75	46	21	54	25	58	30	29	427
6		25	56		53	16	56	48		26	40	320
7				45	60				51			156
8	106	51	71	19	68	42	54	61		50	62	584
9	36	45		41	95	51		25	37	31	34	395
10		52		51	26		39	58		22	52	300
11	110		44		61	60		27			67	369
12			13			23	77	67		52	31	263
13	84	26	22	43	51		42	15	36	23	47	389
14				18	42		24	48				132
15	135	51	65	46	27	38			43	66	25	496
16	94	25					57	50			63	289
17		33	31	49	68	19	93	92	50	61	34	530
18	127	58	78	65	60	40	65	47	57	64	71	732
19		56	52	24	101	77	57	49		49	42	507
20	146	91	58	16	110	113		73	60	36	64	767
21		60		47		128	58				59	352
22	107	17	43		76	22	64	101	108	79	34	651
23	25		48	29	68		29	46		64	34	343
24		74	54	20	12	36	77	47	47	23	65	455
25	99	60	59		66	72	65	87	78	29		615
26	29	35	27	10	51	45	50		80		27	354
27		34		27	45	31	109	56		34	47	383
28	22	62				50		84	85			303
29	86	54	62	26	60	41	63	74		49	34	549
30			47					100		76	27	250
31	223		37	58	66	88	101		38		32	643
Total	1,631	1,039	971	759	1,350	1,212	1,281	1,311	903	941	1,110	12,508

[a] No accurate record was kept for the first 12 days' fishing of this fisherman. He made some very large lifts before most of the other fishermen began operations, and his catch was estimated by Mr. Kinney at the number shown.

Table showing the daily catch of chinook salmon by eleven gill-net fishermen landing fish at the cannery of Mr. M. J. Kinney, at Astoria, Oreg., in 1876—Continued.

Date.	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.	No. 8.	No. 9.	No. 10.	No. 11.	Total.
June 1	43	......	80	78	90	82	49	123	......	112	121	778
2	117	......	65	......	100	24	107	82	123	73	108	799
3	114	113	78	67	92	51	11	72	......	117	45	760
5	208	126	26	......	217	222	174	133	111	75	138	1,430
6	172	119	52	116	188	142	74	104	137	67	106	1,277
7	141	56	93	87	145	74	......	97	......	89	130	912
8	......	121	109	......	......	124	72	53	154	51	71	755
9	138	108	63	87	106	56	83	......	......	73	105	819
10	84	52	39	18	12	40	79	91	......	58	72	545
11	......	31	36	......	......	......	......	......	21	......	62	150
12	......	122	25	63	70	139	59	85	173	......	23	759
13	170	61	......	72	89	42	......	78	200	......	117	829
14	171	63	54	72	74	103	51	81	181	......	107	957
15	184	103	92	110	82	68	114	72	......	......	114	939
16	......	67	100	......	74	13	164	89	......	......	80	587
17	77	......	......	......	62	77	44	......	82	......	103	445
19	82	......	82	64	......	62	64	81	19	......	85	539
20	106	......	103	44	......	68	80	......	29	69	105	604
21	43	66	33	58	......	53	80	50	......	......	......	383
22	153	81	87	88	......	48	44	21	70	......	75	667
23	63	47	47	......	132	80	......	79	35	28	45	556
24	80	55	37	157	78	62	135	19	81	43	65	812
25	......	73	......	......	124	......	......	......	......	......	......	197
26	64	......	24	......	......	77	18	92	55	70	79	479
27	128	82	......	94	55	100	140	62	74	25	101	861
28	19	25	......	94	25	100	125	88	42	53	95	666
29	148	96	......	......	12	30	53	186	......	49	80	654
30	126	61	......	110	107	65	125	116	72	72	103	957
Total	2,631	1,728	1,325	1,479	1,934	2,002	1,945	1,954	1,659	1,124	2,335	20,116
July 1	141	61	79	112	113	56	82	105	40	72	81	442
3	166	140	154	115	164	152	48	112	......	103	166	1,320
4	184	132	128	81	100	91	121	103	27	51	132	1,150
5	94	118	66	133	105	......	106	90	61	......	106	879
6	171	95	57	80	206	82	97	49	......	120	88	1,045
7	168	85	73	115	237	102	60	83	......	90	123	1,136
8	91	54	94	68	147	81	60	104	......	94	63	856
9	......	14	......	......	......	......	......	......	......	......	......	14
10	182	22	70	48	90	121	72	52	21	59	82	819
11	128	46	51	78	148	46	89	......	......	75	54	715
12	105	39	41	63	104	65	51	81	......	66	94	709
13	94	......	53	56	95	41	56	34	20	76	83	608
14	144	30	59	44	82	71	74	108	36	66	85	799
15	165	83	73	......	98	......	150	106	6	126	65	872
16	161	37	104	98	170	......	......	......	......	90	200	860
17	132	87	83	90	121	......	65	91	......	......	108	777
18	168	97	......	30	140	......	105	73	......	112	74	799
19	174	110	71	......	127	......	......	94	22	84	95	777
20	92	63	54	35	56	......	113	148	75	104	88	828
21	145	94	83	94	36	......	65	109	53	78	122	879
22	236	78	44	97	......	......	64	80	......	88	77	764
24	113	54	46	82	71	......	77	107	26	76	52	704
25	108	15	33	43	......	......	83	72	94	73	45	566
26	107	50	25	27	64	......	76	50	82	83	34	598
27	90	33	31	31	40	......	53	29	25	91	50	473
28	74	32	66	......	......	......	58	......	47	87	41	405
29	60	19	44	54	26	......	35	65	30	46	26	405
30	56	......	16	......	......	......	......	48	39	......	......	159
31	25	......	13	......	11	......	19	33	56	38	54	249
Total	3,574	1,688	1,711	1,674	2,551	908	1,879	2,026	760	1,548	2,288	20,607
Aug. 1	60	......	34	8	......	......	......	28	27	32	51	240
2	24	......	47	......	8	......	......	62	28	28	52	219
3	46	......	35	......	22	......	......	31	......	56	......	190
4	......	......	15	......	17	......	......	28	......	44	35	139
5	65	......	18	......	33	......	......	25	......	64	26	231
6	48	......	17	......	39	......	......	......	......	......	31	135
7	41	......	14	......	20	......	......	34	......	55	21	185
8	33	......	14	......	24	......	......	12	......	34	20	137
9	11	......	5	......	20	......	......	......	......	......	......	36
Total	328	......	199	8	183	......	......	220	55	313	206	1,512
Grand total.	9,184	4,455	4,206	3,980	6,027	4,122	5,105	5,511	3,377	3,920	5,939	55,832

Notes on the weight of salmon.—Owing to the practice of the canners of buying the salmon only by weight or by number, as may be determined on at the beginning of the season, it is not always easy to obtain accurate figures showing the average weights of salmon, except in small quantities and for isolated dates. The following tabulations and notes may therefore possess some elements of general interest and serve as a basis for comparisons.

In the case of chinook salmon it is found that the largest fish are taken in greatest numbers about June 10 or 20 of each year. The fish running at the beginning and at the end of the season represent the minimum average sizes, the decline in weight from the middle of June being in both directions. In 1894 there was a noteworthy run of very large fish in the lower river about the middle of June. One salmon weighing 74 pounds was landed at the cannery of J. O. Hanthorn & Co., Astoria, which was the largest seen in a number of years; its greatest girth was 45 inches and its length was 56 inches. Seven salmon, caught in gill nets and traps on June 20, and weighing 390 pounds in the aggregate, were found lying together at the cannery of Mr. M. J. Kinney, Astoria.

The average weight of the Columbia River chinook salmon is usually given as 22 to 25 pounds. The detailed data obtained by the writer give 22.76 pounds as the average weight of 104,831 chinook salmon caught in 1893 with gill nets, traps, and seines. The weights vary considerably with the apparatus employed and, as previously stated, with the season. Contrary to the usually accepted theory, the average weight of the fish taken in pound nets is but little less than those caught with gill nets; during the month of June the trap-caught fish are larger than those obtained with gill nets, and there are days in every month when the trap fish will average larger than the others.

The following table is a detailed presentation of the variations in the average weights of chinook salmon, depending on the month and apparatus in which caught. More than 100,000 fish are involved in the comparison, a number which is sufficiently large to warrant generalizations from the figures.

Statement showing by months the number, weight, and average weight of chinook salmon taken with gill nets, pound nets, and seines at the mouth of the Columbia River and landed at a salmon cannery at Astoria, Oreg., in 1893.

Months.	Caught by gill nets.			Caught by pound nets.			Caught by seines.			Total.		
	No. of fish.	Total weight (pounds).	Average weight.	No. of fish.	Total weight (pounds).	Average weight.	No. of fish.	Total weight (pounds).	Average weight.	No. of fish.	Total weight (pounds).	Average weight.
April	6,409	129,052	20.14	146	7,569	18.19	....	....	....	6,825	136,621	20.02
May	23,468	528,498	22.52	1,793	39,922	22.26	....	....	....	25,261	568,420	22.50
June	22,008	530,397	24.10	3,350	86,618	25.86	158	3,804	24.08	25,516	620,819	24.33
July	15,917	374,851	23.58	6,550	146,360	22.35	5,889	131,953	22.41	28,356	653,164	23.03
August	12,892	282,139	21.88	3,109	64,464	20.73	2,872	59,999	20.89	18,873	406,602	21.54
Total	80,694	1,844,937	22.86	15,218	344,933	22.67	8,919	195,756	21.95	104,831	2,385,626	22.76

Some daily comparisons of the weights of chinook salmon caught in gill nets and pound nets, respectively, are presented in the following statement. The figures relate to about three months of the fishing season of 1893. The fish shown were landed at a cannery in Astoria between April 17 and June 28. The smallest average for gill-net fish was 18.49 pounds, on May 6; the largest was 26.15 pounds, on June 3. The smallest average for trap fish was 15.95 pounds, on April 27; the largest was 28.66 pounds, on June 10.

Statement of the daily average weights of chinook salmon taken in gill nets and pound nets at the mouth of the Columbia River and landed at a cannery in Astoria, Oreg., between April 17 and June 28, 1893.

Date.	Gill nets.		Traps.		Date	Gill nets.		Traps.	
	No. of fish.	Average weights.	No. of fish.	Average weights.		No. of fish.	Average weights.	No. of fish.	Average weights.
		Pounds.		*Pounds.*			*Pounds.*		*Pounds.*
Apr. 17	316	21.17	....	....	May 24	1,235	23.44	25	23.68
18	585	21.60	....	....	25	1,090	25.54	9	23.33
19	244	20.68	2	17.5	26	789	23.80	34	23.90
20	67	23.14	16	23.44	27	858	24.53	34	25.14
21	122	21.66	5	20.00	29	944	24.16	74	25.48
24	409	21.13	46	19.04	30	1,358	24.07	66	26.15
25	657	20.54	....	....	31	738	25.60	43	25.41
26	610	20.47	115	18.46	June 1	1.112	25.58	90	26.75
27	401	21.70	66	15.95	2	1,332	24.35	83	24.62
28	335	20.78	57	18.00	3	2,030	26.15	118	24.08
†29	650	21.12	82	18.60	5	848	25.38	117	26.53
May 1	278	*21.60 **22.60	118	17.80	6	1.083	24.98	78	26.99
2	452	22.18	51	17.38	7	490	24.20	350	23.96
‡3	442	21.80	118	18.20	8	1,075	24.21	267	24.62
4	420	21.40	88	16.10	9	895	24.12	31	27.95
5	353	21.27	116	16.51	10	932	23.58	261	28.66
6	737	18.49	62	19.68	12	583	26.08	217	23.92
8	391	21.54	127	18.84	13	1,025	24.56	116	22.82
9	791	23.89	43	19.22	14	462	24.63	13	25.46
10	410	22.26	....	....	15	467	24.67	143	22.27
11	435	22.58	86	19.76	16	694	23.60	14	23.00
12	302	22.01	30	21.60	17	1,357	23.91	78	20.51
13	1.014	21.20	91	19.69	19	572	23.38	226	23.48
15	428	22.88	169	19.65	20	1,389	23.18	207	24.50
16	950	21.75	69	17.92	21	614	22.93	107	24.65
17	863	23.19	78	20.39	22	867	22.44	120	24.94
18	910	22.59	25	20.44	23	517	22.01	3	21.66
19	1,497	22.65	63	21.13	24	601	21.67	153	21.25
20	749	22.85	73	21.13	26	616	23.09	91	23.72
22	958	24.36	66	18.98	27	713	23.19	52	24.73
23	1,418	23.42	32	23.85	28	614	23.49	129	23.13
					Total	27,900	....	3,349	....

*8.75-inch mesh.
** 9.25-inch mesh.
† Salmon taken in small-meshed nets (7-inch) had an average weight of 11.70 pounds.
‡ Salmon taken in small-meshed nets (7-inch) had an average weight of 13.80 pounds.
Note.—During the week ending July 8, 2,488 gill-net fish had an average weight of 24.59 pounds and 1,191 pound-net fish an average weight of 25.59 pounds.

Average figures similar to those given for chinook salmon are available for blueback salmon. The weight of this fish is usually estimated by canners and fishermen at 5 pounds, which is very close to the actual figure. The following table, giving the catch of bluebacks in the same apparatus and by the same fishermen that took the chinook salmon previously referred to, shows that the average weight of 9,921 bluebacks was 4.96 pounds. The largest fish were taken with gill nets, and in May; the smallest with seines, and in April.

Statement showing by months the number, weight, and average weight of blueback salmon taken with gill nets, pound nets, and seines, at the mouth of the Columbia River and landed at a salmon cannery at Astoria, Oreg., in 1893.

Months.	Caught by gill nets.			Caught by pound nets.			Caught by seines.			Total.		
	No. of fish.	Total weight (pounds).	Average weight.	No. of fish.	Total weight (pounds).	Average weight.	No. of fish.	Total weight (pounds).	Average weight.	No. of fish.	Total weight (pounds).	Average weight.
April	2	10	5.00	208	535	2.57	....	....	....	210	545	2.60
May	16	91	5.69	1,792	10,391	5.80	....	....	....	1,808	10,482	5.80
June	91	452	4.97	5,466	26,385	4.83	229	1,102	4.81	5,786	27,939	4.83
July	3	15	5.00	1,801	8,179	4.54	413	2,039	4.94	2,217	10,233	4.62
August	....	....	....	....	....	....	....	....	....	....	....	....
Total	112	568	5.07	9,167	45,490	4.96	642	3,141	4.89	9,921	49,199	4.96

The only other member of the salmon family that is a regular factor in the salmon industry of the lower Columbia is the steelhead. Ten pounds is usually assigned as the average weight of the fish. From the following table, showing the weights in similar form to that exhibited for the chinook and the blueback, it appears that 26,587 steelheads taken in 1893 had an average weight of 10.33 pounds. The fish are largest in August and smallest in April, while those taken in gill nets are heavier than those obtained in pound nets or seines, the seine fish being lightest.

Statement showing by months the number, weight, and average weight of steelhead salmon taken with gill nets, pound nets, and seines, at the mouth of the Columbia River, and landed at a salmon cannery at Astoria, Oreg., in 1893.

Months.	Caught by gill nets.			Caught by pound nets.			Caught by seines.			Total.		
	No. of fish.	Total weight (pounds).	Average weight.	No. of fish.	Total weight (pounds).	Average weight.	No. of fish.	Total weight (pounds).	Average weight.	No. of fish.	Total weight (pounds).	Average weight.
April	18	167	9.28	59	569	9.64				77	736	9.56
May	17	176	10.35	207	2,097	10.13				224	2,273	10.15
June	511	5,049	9.88	4,137	42,907	10.37	426	4,294	10.08	5,074	52,250	10.30
July	847	11,594	13.69	10,031	101,858	10.15	5,827	58,486	10.04	16,705	171,938	10.29
August	647	8,735	13.50	2,305	23,105	10.02	1,555	15,609	10.04	4,507	47,449	10.53
Total	2,040	25,721	12.61	16,739	170,536	10.19	7,808	78,389	10.04	26,587	274,646	10.33

Destruction of salmon in the headwaters.—By some reputable persons considerable stress is laid on the injurious influence on the abundance of chinook salmon in the Columbia River of the destruction of fish in the headwaters. Mr. W. H. Barker, of the firm of George & Barker, of Astoria; Mr. J. O. Hanthorn, of the firm of J. O. Hanthorn & Co., of Astoria, and other canners, as well as regular fishermen and sportsmen, attribute the present relative scarcity partly to the sacrifice in the upper waters, by white men and Indians, of large quantities of salmon that have run the gauntlet of the lower river and deserve protection when they have reached their spawning-grounds. The fish are taken with great facility in the shallow streams constituting spawning-beds, and the quantities killed some seasons are said to have been enormous. The fish taken in such situations are hardly fit for food, being "logy," diseased, and emaciated. At times they have been used on the land by wagon loads. The improvident red man often cuts out the eggs and dries them, discarding all the remainder of the fish.

Mr. Barker has observed obstructions placed across narrow streams up which fish were running in September, October, and November, and has known many hundreds of pounds of ripe fish to be shipped from a single point in Idaho to places in Iowa, Missouri, and other States.

Mr. Hanthorn has known good spawning-grounds to be destroyed by irrigation ditches, the building of which has so reduced the supply of water in the streams that the salmon have ceased to resort to them. The irrigation work is also said to keep otherwise clear streams muddy or "roily," and thus impair their usefulness as spawning-beds.

According to the statements of reliable people on the lower river, blueback salmon have had their spawning-grounds restricted by the erection of dams at the outlet of certain lakes in the headwaters of the Columbia. Favorite breeding-grounds for the small species are now utilized for irrigation purposes, and are said to be dammed against the entrance of fish.

Destruction of small salmon.—The statement has from time to time been made in public print, and the opinion prevails among some persons interested in the fisheries of the Columbia River, that to the destruction of young chinook salmon is to be attributed at least a part of the decline which the industry has undergone. It may be said, however, that most persons attach very little importance to the taking of small fish; and the special committee of the Oregon legislature appointed to investigate the fisheries of the State seemed inclined to favor rather than oppose the capture of the small fish found in the Columbia, on the ground that they were stunted fish, the multiplication of which tended to impair the quality of the race. The prevalence of the opinion that all the chinook salmon constituting the runs up to August 1, or even later, will naturally die after the completion of the spawning process, is sufficient to outweigh any compunctions that may be entertained as to the sacrifice of small fish.

In proportion to the extent of the fishery, the catch of chinook salmon too small for canning is generally unimportant. During some seasons there is a larger run of small fish than during others, and then considerable quantities may be destroyed. Mr. M. J. Kinney, of Astoria, is authority for the statement that at a seine fishery above Astoria a great many small chinooks were sacrificed in 1893. Perhaps a third of the catch of 50,000 pounds consisted of fish under 4 or 5 pounds in weight. Some were brought to Mr. Kinney, who dumped them overboard and refused to take more, as did other canners. Fish of this size are too small to can. Reference to a table (p. 252) giving the daily catch of salmon at a seine fishery at Brownsport Sands, near Pillar Rock, Washington, shows that in the month of August, 1893, 1,990 pounds of chinook salmon, having an average weight of only 3½ pounds each (some weighing only 1½ pounds), were caught and thrown away because there was no sale. Seines nearer the mouth of the river are reported not to take a great many small fish, and pound nets in the same situation are said to catch very few ordinarily, although some of these small chinooks are thus taken each season. On June 20, at Astoria, a few were seen weighing only 2 pounds; these had been obtained in pound nets.

According to the statements of canners, fishermen, and all other persons connected with the salmon fishery who have had opportunity to make observations, the small chinook salmon in question are all males which, though undeveloped as to size, are sexually mature. This opinion is based on the following facts and hypotheses: (1) That only fish capable of undergoing the reproductive act enter the river; (2) that male fish of this small size are known to have had ripe milt and to have undergone the spawning process; (3) that no female salmon under 7 pounds in weight has ever been taken in the river.

The following remarks on this subject emanate from a report made to the Oregon legislature by a special committee appointed to investigate the fisheries of the State:

> Parties engaged in either of the different modes of fishing named generally insist that that particular mode of fishing is least injurious to the fish interest of the State; and a great deal of complaint has been made and many objections have been urged against fishing with traps, wheels, seines, and similar appliances. The main objection urged against the modes of fishing just enumerated is that they are detrimental to the fish interest of the State in this way, that they destroy very small fish (salmon), and by the destruction of the small fish cause a general falling off in the supply of salmon; and it is urged that this mode of fishing is so destructive that it will ultimately cause the annihilation of the salmon industry of the Columbia. We have, therefore, undertaken to make a thorough investigation of that subject, and have done so to the best of our ability, to such an extent that we feel confident that we have arrived at the proper solution of the question.
>
> The small fish, or salmon, that are caught with the last-named appliances, and which it is claimed are destroyed by such modes of fishing, consist principally of small chinook salmon, and weigh from

3 or 4 to 7 or 8 pounds. They run at the same time and with the large, or what we term the royal chinook salmon. The other small fish caught are blueback and a very few small steelheads. The bluebacks of the sizes caught are what we consider the average of the run, and of the small steelheads that are caught there are too few to be worthy of consideration.

There seems to exist quite a diversity of opinion with regard to the small salmon referred to, some persons asserting that they are small chinook, while others insist, on account of the paleness of the flesh, that they are another and different species, or white salmon. The last claim is made mainly by persons interested in those modes of fishing by which small fish are taken. After a thorough investigation we feel that we can positively assert that those small salmon so taken, not including bluebacks and steelheads, are small chinook salmon, and we shall here give our reasons for coming to that conclusion.

During our investigation up and down the Columbia we carefully compared those small salmon with the large salmon, and we found that in every respect, except color of flesh, they had the same distinguishing characteristics that the large salmon have. We also had hundreds of those small salmon opened, and every one of them proved to be a male salmon. The smallest female salmon found by us during all our investigation was one caught near Astoria, which weighed 9½ pounds.

The chairman of this committee has had the opportunity of examining into that question for many years. He has examined hundreds—he could safely say thousands—of those small salmon, and all that he has ever examined were male except one, and that one weighed 8½ pounds, that being the smallest female salmon ever seen by him, the next smallest being the one seen by the committee, and weighing 9½ pounds.

Since 1887, Senator L. T. Barin, the chairman of the committee whose report has been quoted, has been offering $25 for any female chinook salmon weighing 7 pounds or less, caught in the nets of the Columbia River fishermen.

Senator Barin has made some interesting observations, which probably throw light on the stunted-fish problem, and has communicated the same to me. Some years ago, on an island at the mouth of the Willamette River, he ascertained that some blind sloughs, inhabited by catfish, contained numbers of small chinook salmon. The sloughs had not been overflowed for two years, to the positive knowledge of Mr. Barin, and the fish must, therefore, have been retained for at least that length of time. They were much stunted in growth, owing, as the observer supposes, to deficiency of food. He thinks that every year larger or smaller numbers of parrs are left in blind sloughs adjacent to the rivers, and are liberated in a dwarfed condition, after one or two seasons, by the recurrence of freshets similar to those which caused their retention. In Mr. Barin's opinion all apparently stunted salmon taken in the river are fish which have been left in sloughs without sufficient food and other suitable conditions. An unexplained fact, however, is that all the small fish appear to be males.

Quality of fall chinook salmon.—The canners lay great stress on the poor quality of fall chinook salmon and the little value they possess for canning. The fish which run in September and October are healthy-looking and have little superficial difference from the spring and summer fish. They are apt to have a somewhat paler flesh, however, and the meat is destitute of oil, which is essential to first-quality fish.

While the ordinary fish will sell for $5.25 per case of 48 one-pound cans, these fish can never be sold as No. 1 fish, and have to be diverted to an inferior trade, not even ranking with good second-class fish. The demand is limited, and their sale tends to reduce the reputation of the Columbia River salmon. The differences between the early and late fish when canned are very marked, and may be appreciated even by a novice. Natural oil of a rich yellow color will be found in a can of fish taken before September, while no oil worthy of mention will be found in the late fish. There is no difference in the size or appearance of the fish, and often little or no difference in the color of the fish before or after cooking.

The opinion is quite prevalent among the canners and fishermen that the fish belong to a different race from the spring and summer fish, being similar to the fall run in the other rivers of the west coast, in all of which the fall run consists of lean fish. The opinion also prevails that the fish hatched from eggs of the fall run will return to the river in the fall and be the undesirable fish, and the hope is general that no attempts will be made to propagate the late fish, but that the efforts of fish-culturists will be centered on the spring and summer broods, which alone are suitable for canning.

Salmon taking food in fresh water.—The opinion and observation of fishermen and dealers coincide in attributing to the chinook salmon the habit of wholly abstaining from food after entering the river.

According to the statements of fishermen there is only one locality in that part of the basin of the Columbia River where commercial fishing is carried on where the chinook salmon regularly take the baited hook ; this is at the falls of the Willamette River, at Oregon City, where anglers use fresh-salmon spawn with great success.

Food consisting of partly digested small fish has repeatedly been observed in the stomachs of salmon taken at or near the mouth of the river. Unmutilated smelts have sometimes been seen to fall from the mouths of chinook salmon when the latter were thrown in a scow or boat. In all such instances, however, the inference is clear that the food was ingested before the fish left the ocean.

During the month of June the angling at the falls of the Willamette River was considered unusually fine, and large numbers of chinook salmon were taken. On June 19 the Portland *Oregonian* contained the following note on the subject:

> The salmon fishing at the falls of the Willamette still continues good, and some fine catches have been made within the past few days. Mr. L. T. Barin caught 21 on Saturday and Al Johnson and Henry Gordon caught over 30. Several others caught from 10 to 20, and in all nearly 100 young chinook were taken in one day, weighing from 2 to 10 pounds, and averaging about 5 pounds. For a country where it is said salmon would not take a hook this is pretty good fishing.

On June 23 the writer made a visit to Oregon City, and found that a large number of fish were then below the falls. The best fishing is from a rocky island lying at the extreme left of the falls, at the only point where it is possible for the fish to ascend. In the course of an hour about 15 chinook salmon, mostly of small size, were taken by a dozen anglers. Most of the fish here caught are under 10 pounds in weight, but a few weighing from 15 to 25 pounds are also secured.

Fishing is done with jointed rods, fitted with 50 to 100 yards of stout line, one or two hooks, and a light sinker. The current is very swift and strong, and the line is cast up under the falls and permitted to drift downstream. From 10 to 25 yards of line are usually paid out. The only bait used is fresh salmon spawn. This is cut into pieces of the size of a cubic inch, and is placed on the hook as securely as its consistency will permit. The vivid red color which the spawn naturally has gives place to a pale pinkish or white color after immersion in the water.

Periodicity of run of bluebacks.—A study of the statistics of the salmon fishery of the Columbia River collected by the U. S. Commission of Fish and Fisheries during the past five or six years discloses an interesting feature of the run of blueback salmon. The figures show that the fish are much more abundant in the alternate years. Many of the salmon-canners and fishermen have overlooked this fact, which, when the matter has been brought to their attention, has been clearly demonstrated by reference to their records. So far as generalizations may be made from the data at hand, the

relative abundance of bluebacks during any given season may be with certainty predicted. In this respect the blueback resembles the humpback (*O. gorbuscha*).

The greatest abundance of the blueback salmon in the Columbia River corresponds with the even years. The catch in those seasons so far exceeds that during the odd years as to clearly establish the contention of a biennial run. The following statistical data, based on the book records of canners and others, show that in 1890 and 1892 the catch of bluebacks was more than three times larger than in 1889 and 1891. Complete figures are not available for the years 1893 and 1894, but the information at hand indicates, and the testimony of the canners and fishermen bears out the statement, that in the former year the run was small, and in the latter was larger than for five or six years, and probably larger than ever before known.

Statement of the number of blueback salmon caught on the Columbia River from 1889 to 1892, inclusive.

Years.	Number of fish caught.
1889	324,532
1890	994,471
1891	287,826
1892	1,064,358

As a matter of related interest it may be mentioned that the run of bluebacks in the Fraser River is similar to that in the Columbia in its periodicity, the difference being that the fish are most abundant in the odd years. An examination of the official reports of the Canadian Department of Marine and Fisheries shows a well-established biennial feature of the run. In the year 1893 the run was extraordinarily large, corresponding with the very small catch in the Columbia, and immediately preceding the phenomenally large run in the Columbia in 1894. Whether there is anything more than a mere coincidence in this alternation in the abundance of the fish in these two great rivers remains to be determined. It is not impossible, however, that the fish entering these streams belong to the same general body, and that a large run in one river is more or less at the expense of the other.

Condition of the water as affecting the catch.—As in the case of all river fisheries, there is in the Columbia a certain relation between the abundance of fish at a given time and the resulting catch on one hand and the condition of the water on the other. The following notes are a meager contribution to the subject of the dependence of the catch on the water. The unprecedentedly high water which prevailed in the Columbia basin in May and June, 1894, interfered to some extent with fishing with all forms of apparatus, although the damage done was much less than was at first anticipated and reported. The most serious injury resulting from the freshets was done to the wheels located at the Cascades and The Dalles, where the rise of the water was greatest. Owing to the expensive character of the wheels the financial losses were very heavy. Of 19 scow and 8 stationary wheels in operation at the Cascades at the time the freshets began, 7 of the former and 4 of the latter were either entirely lost or seriously damaged.

Up to June 20, 1894, the reported shortage in the salmon pack of the Columbia River was due almost entirely to the loss of time and apparatus occasioned by the floods. With the subsidence of the high water the run of bluebacks and chinooks became so numerous, and the catch of bluebacks in wheels and pound nets and of

chinooks in gill nets was so large, that the shortage was overcome, and the aggregate season's pack was much larger than last year.

Trap fishing in Baker Bay and the lower river was somewhat interfered with by the large amount of driftwood brought down by the freshet. Many of the traps, especially those on the edge of the channel, became clogged or were torn by brush, logs, etc. A few stakes were also washed out by the high water. Swift currents and floating débris also interfered with the setting of gill nets and the hauling of seines.

As is well known, the wheels require a certain amount of high water in order to do well. At the Cascades it is found that the largest quantities of fish are taken when the height of the river is 20 to 25 feet above mean low water. Several explanations of this circumstance are offered. Some hold that more fish are prompted to enter the river when an unusually large volume of fresh water is being poured into the ocean. Mr. Frank M. Warren, who operates wheels extensively and has had much experience in the matter, attributes the larger catch during high water to the fact that the nets in the lower river can not take so many fish and that a larger number are able to reach the wheels. During the prevalence of high water the gill nets in the lower river do not so effectually sweep the bottom, and new channels are made on the sides of the river, up which the fish may pass unmolested. For detailed data showing the relation between the height of water and the catch in wheels, reference is made to the table giving the yield of certain wheels at the Cascades.

The clearness or muddiness of the water has an important bearing on the success of the fishing operations of trap and gill net fishermen. Trap nets always do best when the water is clear, and gill nets take the most fish when the water is muddy. It therefore usually happens that when traps are making large catches the gill nets are likely to have poor luck. The explanation of these phenomena seems to be as follows: In muddy water the salmon swim into the gill nets before becoming aware of the existence or nature of the obstruction; on the other hand the leader of a pound net, with its fine meshes often occluded by grass and other drift material, acts as a solid barrier, and when the salmon swim against it they quickly withdraw and move in other directions. When the water is clear, the fish readily see the gill nets at some distance and do not attempt to go through them, but swim along the side of the nets and go round the ends. In the case of the leaders of traps, the fish act the same way and are led into the nets, the tendency of the salmon being to go into the heart rather than toward the free ends of the leader, for the reason that the water becomes deeper in the direction of the pocket.

STURGEON AND THE STURGEON FISHERY.

CALIFORNIA.

The white sturgeon (*Acipenser transmontanus*) is one of the most prominent food-fishes of the State, its edible qualities and economic value being of high rank. The capture of sturgeon for market is practically restricted to San Francisco Bay and the lower reaches of the Sacramento and San Joaquin rivers. The fish is taken with large-meshed gill nets, in salmon nets, and with set or troll lines provided with unbaited, barbless hooks. The principal part of the yield is obtained with set lines. In 1893, for the first time, a license was required for the use of sturgeon set lines. A license fee of $10 was charged to each fisherman.

Up to the middle of June, 60 licenses had been granted to fishermen, distributed as follows in four counties:

Fishing center.	County.	No. of fishermen licensed.
Martinez	Contra Costa	8
Black Diamond	do	5
Seal Island	do	2
Marsh Landing	do	2
Antioch	do	5
Jersey Landing	do	2
Bouldin Island	San Joaquin	3
Benicia	Solano	2
Benicia Flats	do	1
Roe Island	do	2
Long Island	do	2
Cut Off	do	5
Suisun Creek	do	6
Montezuma	do	3
Broad Slough	do	3
Dutton's	do	3
Lakeville	Sonoma	4
Petaluma Creek	do	2

The law by virtue of which these licenses are issued (section 636 of the penal code) has a limited value so far as the protection of sturgeon is concerned. Its utility arises from the fact that it enables the State fish commissioners to regulate the size of the hooks used, to keep a check on this method of fishing, and to secure a small fund with which to carry out the patrol of the State waters. The commissioners have no discretion in issuing licenses, and can not regulate the methods, the fishing season, or the quantity of set lines employed by individual fishermen.

The method of taking sturgeon with set lines is generally and justly considered very destructive and cruel. It probably originated in China and was for many years extensively practiced by the Chinese fishermen of California. Recently, however, the use of set lines by the Chinese has been interdicted.

One of the features of the method which makes it especially harmful is the destruction of immature fish. Very large quantities of sturgeon only 15 or 18 inches long are often seen in the markets. The sacrifice of small sturgeon is said, however, to be unavoidable, as the fish that are snagged by the hooks are injured so severely that even if liberated alive most of them would soon die.

Regarding the abundance of sturgeon, it may be stated that while fishermen and dealers acknowledge that the supply is much less than it was prior to ten years ago, still the catch during the past four or five years seems to have been about uniform and appears to be undergoing no reduction.

Sturgeon are usually received at the stalls of the wholesale dealers in a round condition. The fishermen are paid, however, only for the decapitated and eviscerated carcass and for the roe. The latter is made into caviar by some of the dealers. The proportion of the weight of roe and waste parts to the total weight may be judged from the following figures applying to a large female sturgeon examined in the San Francisco market June 11, 1894:

	Pounds.
Total weight	243
Weight of roe	51
Weight of head and viscera	62
Weight of dressed carcass	130

Nearly the entire catch of sturgeon is consigned to San Francisco, in the markets of which city the fish is constantly found. It is there known by the trade names of "sturgeon," "bass," "white salmon," and "tenderloin sole." In restaurants and hotels sturgeon is commonly served as "tenderloin sole," which represents the choicest cut of the fish.

Small numbers of the green sturgeon (*A. medirostris*) are caught and find a market in San Francisco. The prejudice against this fish is too strong, however, to permit the sale of many, and the price received is less than half that commanded by the white sturgeon.

THE COLUMBIA RIVER.

The sturgeon utilized in the Columbia is the white sturgeon, the same species which is taken in California. The green sturgeon is also found there, but, as in California, is only sparingly eaten, and in most places is totally discarded. The white sturgeon is found in the river every month in the year, but it is most numerous in July and August, when the sardines are running, and in January and February, when the smelt are found in abundance. The sturgeon feeds on these fish. Writing of the sturgeon of the west coast at a time when its commercial importance in the Columbia River had not brought it into the prominence it has since had, Dr. Jordan said:

> It reaches a length of 8 or 10 feet or more, and is said to attain a weight of 400 to 500 pounds. We have seen none of over 150 pounds weight.

The average gross weight of sturgeon taken in the regular sturgeon fishery of the Columbia is about 150 pounds. Fish weighing 500 pounds and even more are not rare. In 1892 one weighing 800 pounds was taken off Oak Point, and in the previous year one weighing 848 pounds was caught near Kalama, this being probably the largest sturgeon ever taken on the west coast.

The history of the sturgeon fishery of the Columbia River is that of most other streams in which the sturgeon has been assiduously sought. For many years no attention was paid to the fish and its value was not recognized. It was generally regarded as a nuisance by the salmon fishermen, who emphatically expressed their contempt for such a fish whenever it was caught in the salmon nets by quickly knocking it in the head and throwing it away. The institution of a regular fishery for sturgeon dates from 1888. During that year some fishing camps were experimentally located on the river, and the abundance of fish led to the establishment of a permanent business, contingent on the presence of fish.

Practically the entire catch has been taken with set lines armed with unbaited, barbed hooks.

Most of the fishing has been done in that part of the river below Kalama, although it is also carried on as far up as the Cascades. The fishing season extends from the close of the salmon-packing, about August 10, to the opening of the salmon season, about April 10. The sturgeon fishery thus occupies the attention of the fishermen at a time when other fishing has been suspended. The inquiries conducted in 1889 and 1892 by Mr. W. A. Wilcox, of this Commission, showed that in the first year of this fishery (1888) nearly 1,000,000 pounds of dressed fresh and pickled sturgeon, valued at $15,000 to the fishermen, were shipped from points on the river. The business steadily increased until, by 1892, over 2,900,000 pounds of dressed fish were sold, which, together with various secondary products (caviar, isinglass, and "bone"), had a value of over $41,000.

The sturgeon meat is practically all shipped east, the bulk of it going to Sandusky, Ohio. The carcasses are cut into pieces of convenient size, which are frozen solid and then loaded into refrigerator cars for transportation. Up to the time of Mr. Wilcox's visit in 1892 the sturgeon had been found in ample abundance for the purposes of the firms engaged, but at that time the fishermen were beginning to experience some difficulty in taking as many fish as formerly. They were obliged to move from one fishing-ground to another more frequently than had previously been necessary and they were compelled to use larger quantities of apparatus in order to keep up the catch. In the season of 1893–94 there was a very perceptible decrease in the supply and the fishery was generally regarded as being on the decline. Under date of February 15, 1894, Mr. C. B. Trescott, who is extensively engaged in sturgeon fishing and shipping, wrote to the Fish Commission as follows, regarding the condition of this industry on the Columbia River:

> Sturgeon fishing has completely failed on the Columbia. There has been no fish caught since last November to amount to anything. At present the entire catch on the river does not amount to over 1 ton of dressed fish a day, and is growing less. We do not expect to be able to fish longer than the 15th of March, and what few we get now do not pay for handling. At present we do not have much faith in the sturgeon business on the Columbia. Usually we have a good run of fish in January or February, but there are no fish this year and there is every indication of the fish being caught out. We have thought that we would have our usual run of sturgeon on the Columbia in January and February. The sturgeon season will begin again on the 15th of August, and if we do not have our usual run of fish then it will prove that the sturgeon fishing is done for here. There is every indication of the sturgeon business having seen its best days on this coast. The total catch for this season has not been 25 per cent of the catch last season, and what fish were caught were caught in August, September, and October.

The suggestive remarks of Mr. Trescott are in accord with what might have been expected as a result of the useless waste of enormous numbers of small fish taken in wheels, pound nets, and other nets, supplemented in the past five years by the very active use of set lines, by which very large quantities of spawning fish have been sacrificed. Regarding the destruction of sturgeon in wheels in 1888 it was said:

> The wheels often take in a day many tons of sturgeon less than 50 pounds in weight. Such are not marketable and are now thrown into the river. Their utilization would be a blessing to the fisherman, for they now help to contaminate the water.—(Report on the Fisheries of the Pacific Coast. U. S. Fish Commission Report, 1888.)

In an interview with Mr. M. J. Kinney, of Astoria, he made the following remarks concerning sturgeon in the lower river:

> In 1893 there was a good supply of sturgeon. The fish sold for 2 cents a pound. The fishermen as a whole did not do well, however, although the price received was double that of the previous year. In 1879 the sturgeon were so thick in Baker Bay that we did not consider it safe, early in the season, to put our gill nets out. The fish were so numerous and large that they were able to destroy a great amount of netting. For years every sturgeon taken was mutilated or killed with an ax and thrown back into the water. The shores of the river would be lined with dead sturgeon, and numbers could always be seen floating down the river. It is quite different now.

The destruction of small unmarketable sturgeon in trap nets must be extremely large in the course of a season. The salmon fishermen pay little attention to the sturgeon and have no interest in the preservation of the supply. A salmon trap near Sand Island, lifted on June 23, was observed to contain over 50 sturgeon, none over 2 feet long, and some only 10 or 12 inches long, all of which were dumped into the boat and consequently destroyed. On this occasion only a few salmon were caught, which were gaffed out of the net, and it would have been an easy matter to permit the small sturgeon to escape.

When the large number of salmon traps in the lower Columbia is recalled, and when the larger or smaller quantities of sturgeon caught at nearly every lift are taken into consideration, it may be readily understood that the annual loss must be enormous and must have had an appreciable influence on the abundance and catch. It is difficult to avoid the conclusion that the present scarcity of sturgeon of marketable size in the Columbia River must be at least partly attributable to the destruction of small fish in the manner stated, which has been becoming greater each year with the increase in the traps.

LAMPREYS.

Inquiries regarding the results of the attempted acclimatization of the eel (*Anguilla chrysypa*) on this coast are apt to elicit misleading information unless great care is exercised. In the San Francisco markets one learns that eels are not infrequently exposed for sale, and that both salt-water and river fishermen catch them occasionally, but an examination of the reported eels usually shows them to be lampreys.*

The only "eel" of the west coast that attracts the notice of fishermen is the three-toothed lamprey (*Entosphenus tridentatus*), which ranges from Monterey to Canada, and ascends all the major streams. It is especially abundant in the Columbia basin. The San Francisco market steamers fishing paranzellas off Drake Bay are said to take these "eels" at almost every haul. The lamprey has no commercial value except in the region of the Columbia River and its tributaries. Here it has the habit of ascending the streams in large bodies and of clinging to the rocks at falls, where they are entirely oblivious to the presence of man and may be easily picked off by hand. They are considered excellent bait for sturgeon, and several hundred barrels were formerly salted annually for that purpose.

The largest runs of lampreys are often coincident with those of salmon.

At the falls of the Willamette River, near Oregon City, Oreg., on June 23, the rocks at the particular part of the falls where salmon ascend were at times completely covered with lampreys. In places where the force of the current was least they were several layers deep, and at a short distance the rocks appeared to be covered with a profuse growth of kelp or other water plants. A lamprey dislodged by the force of the current or by an angling rod would often carry half a dozen others with it to the bottom of the falls. At the sides of the falls, numbers of lampreys had drawn themselves entirely out of the water to avoid the current or remained hanging from the rocks with only their tails in the water. In the turbid water beneath the falls hundreds of lampreys could be seen trying to get a position on the rocks, some being those which had been swept from the rocks above, others being new arrivals from the salt water. This noteworthy run had been in progress for about a week, and was synchronous with the movement of chinook salmon elsewhere alluded to.

It appeared to me that only a very small part of the run could ever surmount these falls, over which, as has been stated, salmon must have passed with the greatest difficulty. The bodies of most of them showed the effects of the rough usage received; the posterior part of some was worn off fully one-fourth the total body length by being whipped against the surface of the rocks while the head remained fixed; and numbers were seen to lose their hold, fall back in the water, and float away apparently dead, emaciated, and covered with bruises and fungus.

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* A few true eels have been taken in California, but they are now very rare and seldom seen.

THE SPINY LOBSTER OR CRAWFISH (Panulirus interruptus).

This valuable crustacean is regularly exposed for sale in the markets of San Francisco and other cities of the Pacific coast. Its distribution, however, is restricted, as it is not abundant and not taken in noticeable quantities north of Santa Barbara County. South of that limit it is extremely numerous and exists in sufficient abundance to supply all present demands.

With commendable foresight the California fish commissioners have thought the time might come when unrestricted capture of the "crawfish" would greatly reduce the production, and have taken measures to avert, as long as may be, a diminution in the supply. While no laws applicable to the entire State have thus far been enacted, several counties have, at the solicitation of the fish commissioners, passed local ordinances. The following action by Los Angeles County has also been taken by San Diego and Ventura counties; other counties interested will soon adopt similar regulations:

Every person who, in the county of Los Angeles, State of California, shall take, catch, or kill, or sells, exposes or offers for sale, or has in his possession, any lobster or crawfish between the 15th day of May and the 15th day of July of each year, shall be guilty of a misdemeanor.

Every person who, in the county of Los Angeles, State of California, shall at any time buy, sell, barter, exchange, offer or expose for sale, or have in his possession, any lobster or crawfish of less than 1 pound in weight, shall be guilty of a misdemeanor.

The purport of the first of these provisions is to secure the protection of the spiny lobster during the period when the eggs carried by the female reach maturity and hatch. All the female lobsters examined by the writer in May and June had eggs attached, and it is evident that the close season stipulated in the ordinance quoted is the proper one. The eggs are of a brilliant brick-dust red color, and are much smaller than the eggs of the true lobster (*Astacus americanus*) of the east coast, their diameter being between one-third and one-half that of the latter.

The spiny lobster is caught in a kind of dip net, or drop net, similar to the apparatus employed for taking crabs. It is baited with fish or meat, lowered into the water from a boat, and raised at intervals. Regular lobster pots are also employed at various places.

Spiny lobsters are shipped to market alive in sacks holding from 50 to 75 pounds, and are displayed on the counters of the dealers, like lobsters on the east coast. Considerable numbers are also at times boiled by the dealers and sold in that condition. When cooked, the spiny lobster acquires the intense red color which in the true lobster is so familiar.

Some of the spiny lobsters exposed for sale are very large, and others are relatively quite small. Examples observed by the writer on June 1, in San Francisco, weighed as much as 8½ pounds, and those weighing 10 pounds can not be rare. Six-pound and 7-pound individuals are common. The average weight of those sold in San Francisco is between 2 and 4 pounds.

The spiny lobster appears to be a more active, if not a more intelligent, animal than the true lobster. It easily moves through the water with greater speed than the eastern lobster, and it also seems endowed with a faculty for escaping capture that the Atlantic representative does not possess. Experiments made with the typical pot, which is so efficacious in the taking of the lobster, have demonstrated that the spiny lobster is often able to escape from that form of trap. The California Fish Company, of Los Angeles and San Pedro, had a large number of lobster pots made with vertical and oblique entrances for the capture of spiny lobsters to be used for canning purposes at its factory in San Pedro, but, according to the reports of the company, little success

attended their use. It was stated that the "crawfish" would enter the pots, eat the bait, and then depart.

In the absence of other similar crustaceans, the spiny lobster occupies an important place among the aquatic food animals of the west coast. It is, however, much inferior to the eastern lobster, the flesh being coarser and less tender.

TERRAPIN AND TERRAPIN-FISHING.

The question is often asked by eastern fishermen and dealers whether the diamond-back terrapin is found on the Pacific coast, and, if not, whether there is an acceptable substitute therefor.

The diamond-back terrapin (*Malaclemmys palustris*) does not exist on the west coast, and the genus is not there represented. The California terrapin (*Chelopus marmoratus*), the only member of the order which has as yet attained commercial prominence on the coast, is much inferior to the diamond-back in food value. It inhabits the rivers and fresh-water ponds west of the Sierras, and its range extends from Monterey to the Canadian border. It prefers warm, sluggish water, and is especially abundant in California.

The nets used in this fishery are simple, inexpensive fyke nets, although they are not designated as such anywhere in the State, being called "turtle nets" and "turtle traps." The prohibition by the State of the use of set nets of any kind makes this fishery illegal, but the law was enacted for the purpose of preventing the capture of shad, striped bass, and other desirable fresh-water fish on the spawning-grounds or in an immature condition, and was not intended to limit the turtle fishery. So long, therefore, as these nets take only terrapin and catfish, carp, chubs, and other similar species generally regarded as nuisances, the legal question is waived.

A fyke examined by me at Sherman Island in the San Joaquin River on June 10, 1894, may be described as follows: The framework consisted of 3 light iron hoops of uniform size, 20 inches in diameter. A short funnel, with a horizontal, elliptical opening about 6 inches wide, extended from the first hoop, the aperture being rather nearer the top than the bottom of the netting. It was held in position by means of cords running to the second hoop. The size of the mesh is about 2-inch stretch. The net is kept in position by means of stakes, to which the first hoop and pot are tied, and also by a stake placed on each side of each hoop piercing the netting and driven into the bottom. The bait is suspended by a cord from the top of the second hoop. A piece of rope attached to either side of the lower part of the first hoop facilitates the lifting of the net. Value about $1 or $2.

The terrapin are very numerous in the marshy lands of the Sacramento-San Joaquin delta and around San Francisco Bay. As many as 16 to 20 turtles are sometimes caught in a trap at one lift. Their size is, however, small as compared with the diamond-back terrapin of the east coast, and examples over 5 inches in length are not common, although the species is said to attain a length of 8 inches. They are generally called "turtles" by the fishermen.

Much of the terrapin fishing in California is semiprofessional or incidental to salmon-fishing, although a few persons devote considerable time to the business, and may be classed as regular "turtle" fishermen. The greater part of the catch is marketed in San Francisco, where the terrapin are exposed for sale throughout the year. The annual sales in that city are about 1,500 dozen, with an average value of $4 per dozen.

The conditions seem excellent for the successful introduction of the diamond-back terrapin to the west coast. The extensive salt marshes around San Francisco Bay and in other places would doubtless supply a suitable habitat for the animal, whose high food value would in time bring it into active demand and stimulate cultivation and a profitable trade.

THE MARKET FISH AND THE FISH TRADE OF SAN FRANCISCO.

There are few cities in the United States in which such a large variety of fresh fish is found in the markets or in which the supply is so constant as in San Francisco. Not only is there a varied fish fauna in the immediate vicinity of the city that is utilized by a large resident fishing population, but the fresh and salt waters of the three coast States contribute their rich resources to the city's supply. Over 100 species may be seen in the markets during a season, and perhaps half that number may be found at almost any time. The quantity of fresh fish landed and sold in San Francisco, as determined by the agents of the Fish Commission, is from 9,000,000 to 12,000,000 pounds annually, worth to dealers from $600,000 to $800,000.

Among the fishes which are handled in largest quantities in San Francisco are the salmon, flounders, herring, shad, smelt, sturgeon, suckers, anchovies, cultus-cod, viviparous perch, and rock-cod, of each of which more than 100,000 pounds are annually sold.

During the latter part of May and the first of June, when I visited the wholesale markets regularly, the following fishes were observed. The scientific names are necessary for their proper identification; the common names given are those heard in San Francisco. A few data collected concerning these are added.

FISHES.

Acipenser medirostris. *Green Sturgeon.* Rarely exposed for sale. Brings about half the price of the white sturgeon.

Acipenser transmontanus. *Sturgeon; White Sturgeon.* Of constant occurrence in the market. A great many small fish under 2 feet in length received. The bulk of the supply is from the Sacramento River region.

Ameiurus albidus. *Catfish.*

Ameiurus nebulosus. *Catfish.* These exotics are almost invariably sent to the market in a dressed condition; it is only in that state that they meet with any sale. The dealers do not encourage the shipment of catfish by the fishermen, and the quantities sold are disproportionate to the abundance of the fish.

Ptychocheilus oregonensis. *Pike.* This large representative of the minnow family is sent to the San Francisco market chiefly from the Sacramento and San Joaquin rivers. The fish is large enough to be taken in salmon gill nets, but it has such little market value that it receives scant attention from the salmon fishermen. Fish weighing 4 to 7 pounds were seen. The price is only 2 or 3 cents a pound, and the demand is chiefly among the Chinese.

Cyprinus carpio. *Carp.* The carp does not rank high as a food-fish in San Francisco, although considerable quantities are annually sold. The local Chinese fishermen catch a part of the supply, the remainder coming from the Sacramento and San Joaquin rivers. The receipts give no idea of the abundance of the fish, and doubtless the catch could be easily increased fifty times were it required by the trade. The average price of the carp is about 2 cents a pound.

Clupea sagax. *Sardine.* Very few sardines were seen, and, as elsewhere stated in this report, the fish is much less abundant in San Francisco Bay than it was comparatively few years ago.

Clupea sapidissima. *Shad.* Very numerous at all times. Found in the markets every month in greater or less abundance. The supply greatly exceeds the demand, and the price is so low that the shad becomes available even for the impecunious Chinaman. The dealers are obliged to restrict the receipts, otherwise the markets would be continually overrun. The prices paid by the dealers vary from one-half a cent to 4 cents a pound, the average being 2 cents. As fine shad as are ever seen in the markets of the Eastern States, weighing from 4 to 7 pounds, may now often be bought at retail in San Francisco for 10 to 15 cents. The supply comes chiefly from local fishermen in San Francisco Bay and from the Sacramento River.

Stolephorus ringens. *Anchovy.* This was perhaps the most abundant fish in the markets during the period of my visit.

Oncorhynchus chouicha. *Chinook salmon.* The sales of fresh salmon in San Francisco amount to over 3,000,000 pounds annually, the larger part of which quantity consists of chinook salmon and comes from the waters of California. The fish are most common in the markets during April, May, and August, but are exposed in all the other months, except September, during which month there is a close season, when the salmon receipts are from points outside the State. The following statement of the quantities of salmon handled by the San Francisco dealers in each month in 1893 and 1894 (to June 30) has been prepared from the records of the dealers, and has been furnished by the California Fish Commission, through Mr. John P. Babcock, chief deputy:

Statement of the receipts of California fresh salmon by the San Francisco dealers.

Months.	1893.	1894.
	Pounds.	*Pounds.*
January	137,460	128,556
February	93,263	103,801
March	139,401	163,131
April	374,478	211,552
May	325,170	242,126
June	70,216	138,675
July	149,217	
August	575,609	
September		
October	249,753	
November	183,789	
December	155,090	
Unclassified*	135,455	84,084
Total	2,588,901	1,071,925

* Salmon handled by minor dealers, whose monthly receipts can not be shown separately.

Data are available showing for much the larger part of the salmon receipts the sources whence they came. The Sacramento basin furnishes more than two-thirds the quantity handled. Eel River, in Humboldt County, and the ocean adjacent to Point Reyes also supply a considerable proportion. The monthly receipts, specified by localities, are shown in the following table:

Statement for a part of the fresh-salmon receipts in San Francisco, showing in pounds the localities from which the fish came.

Months.	1893.					1894.				
	Sacramento River.	Humboldt County.	Ocean.	All other rivers.	Total.	Sacramento River.	Humboldt County.	Ocean.	All other rivers.	Total.
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
January	20,768	110,574		5,058	136,400	28,530	96,485			125,015
February	55,306	33,616		1,189	90,111	38,398	50,557		5,753	94,708
March	117,334	6,150		6,292	129,776	129,191	11,265		13,031	153,487
April	346,053			1,895	347,948	175,651			3,069	178,720
May	309,964		672		310,636	203,741		1,589		205,330
June	44,196		16,666		60,862	120,146		6,131		126,277
July	17,382		105,521		122,903					
August	515,701		29,072		544,773					
September										
October	182,139	40,873			223,012					
November	39,628	143,049			182,677					
December	47,946	99,303			147,249					
Total	1,696,417	433,565	151,931	14,434	2,296,347	695,657	158,307	7,720	21,853	883,537

Salmo gairdneri. *Steelhead.*

Salmo mykiss. *Lake Trout.* A few seen which had been shipped from Oregon.

Salmo mykiss henshawi. *Lake Tahoe Trout.* Very common.

Atherinopsis californiensis. *Smelt.* During my visit this smelt was more or less abundant. It is popular and brings a good price. The specimens examined were in a spawning condition.

Sphyræna argentea. *Barracuda.* Reaches San Francisco from points south of that city, the bulk of the supply coming from the extreme southern part of the State.

Scomber colias. *Mackerel.* This fish, the bull's-eye or chub mackerel of the east coast, has great food value in San Francisco and always meets with ready sale. No large quantities were seen, but several boxes full were observed on a number of occasions between June 6 and 13. The fish weighs about 3 pounds, and sells in the markets at 10 to 20 cents a pound.

Sarda chilensis. *Bonito.* Weighs 10 to 15 pounds. Comes chiefly from the south.

Trachurus picturatus. *Horse-mackerel.* Not uncommon.

Orcynus alalonga. *Tunny.* A few observed that weighed 20 or 25 pounds.

Archoplites interruptus. *Perch.* One of the best fresh-water food-fishes of the coast. Its abundance has greatly decreased of late, and the price keeps correspondingly high, averaging more than double that of the chinook salmon. The greater part of the supply comes from the Sacramento River.

Roccus lineatus. *Striped Bass.* The most common name by which this fish is known on the east coast, viz, rockfish or rock, is fortunately never used in California, the designation rockfish being reserved for various species of *Sebastichthys.* The striped bass is found in the city markets at all seasons; in fact, there is not a day in the year when it may not be looked for. The average weight is 10 pounds, although a great many smaller fish are sold. In 1890 the board of supervisors of San Francisco County passed an ordinance making it unlawful to buy, sell, or have in possession any striped bass weighing less than 8 pounds. In 1891 the ordinance was amended reducing the minimum weight to 3 pounds.

Seriphus politus. *Kingfish.* A few seen every day, but no large quantities observed. The bulk of the receipts comes later in the summer.

Embiotocidæ. *Perch; Salt-water Perch.* Numerous species of this interesting family were seen in the markets daily, the most abundant being *Ditrema jacksoni,* the black surf-fish, and *Hysterocarpus traski,* the "perch" of the fresh-water streams of this region. The boxes in which these fish are kept in the markets and the stalls on which they are exposed were littered with the young.

Hexagrammus decagrammus. *Sea Trout; Rock Trout.* Common.

Ophiodon elongatus. *Codfish.* Even at this late day there are many San Franciscans who believe the true cod is found in the waters immediately adjacent to the Golden Gate, and this fish, the cultus-cod, is sold by no other name than codfish in the markets of California. Indeed, I was approached by at least one dealer who wished me to state that the fish he had on his stall was a genuine cod. The fish is found in San Francisco Bay and in the adjacent sea at all times. Examples weighing 10 to 20 pounds were observed.

Sebastichthys, species. *Rockfish; Rock-cod.* The members of this genus are among the most abundant and important fish found in the markets. The annual sales are considerably over 1,000,000 pounds, the ruling market price being from 6 to 10 cents a pound. Several species of rockfish, in varying quantities, but usually abundant, were noticed every day. Those positively identified were the red rockfish (*S. ruber*), the most abundant species, the black rockfish (*S. mystinus*), the orange rockfish (*S. pinniger*), and the yellow-tailed rockfish (*S. flavidus*).

Microgadus proximus. *Tomcod.* The diminutiveness of the tomcod would naturally be expected to place it at a great disadvantage among the many large fishes of this coast having recognized food value. On the contrary, however, the sales are quite large and the prices are good, although much less than a few years ago.

Hippoglossus hippoglossus. *Halibut.* A few are taken by the San Francisco market fishermen, but the supply is always small and uncertain, and the price commanded by the fish is very high, running from 10 to 25 cents a pound. This condition of affairs offers a good opportunity for the establishment of a halibut fishery out of San Francisco, and it seems probable that a very remunerative fishery might in time be built up. In the early part of June, 1894, a vessel reached San Francisco from the banks off the northern coast with 75,000 pounds of fresh halibut.

The result of this venture is thus described in the *Examiner* of June 10:

"The fish war which has been agitating the local fishermen for the past ten days is now over for the present. Capt. D. Johnson, of the schooner *Elwood*, who came down from the northern waters with a cargo of halibut, has sold out, and it will be five or six weeks before he will be back with another load. When the *Elwood's* cargo arrived halibut was retailing at 25 cents a pound, and it was scarce at that. Captain Johnson offered to sell all his fish to the Fishermen's Union at a very small price, but they would not accept it, and the captain opened up a fish market on the deck of the schooner, selling retail at 5 cents a pound. He kept two men busy cutting up the fish for customers, and in five days the whole cargo of 75,000 pounds was sold. When the Italian fishermen heard the *Elwood* was coming with a cargo of halibut they informed the customs officials that the schooner was coming down the coast with opium. That information was sent to the sound, and when the *Elwood* was passing Cape Flattery a revenue cutter overhauled her, but only fish and ice were found on board. When the vessel tied up at the dock the health inspectors were informed that she had a cargo of rotten fish, and an inspector was sent to her at once, but he bought the largest fish he could find and took it home for his own table. None of the fish-dealers dared handle the halibut for fear of being boycotted by the local men, and Captain Johnson was forced to open a market or throw the fish overboard.

"As soon as he began to sell the local men got into their boats and every net in San Francisco was set for fish. They hoped to make a good catch and glut the market, but luck was against them and they returned almost empty. There was consequently a big demand for halibut, and now the schooner is cleared of her cargo. The local fishermen say that another cargo shall not be sold in San Francisco."

Paralichthys californicus. *Halibut.* Commonly sold under the name of halibut.

Psettichthys melanostictus. *Sole.* Only a few seen.

Pleuronectes stellatus. *Flounder.* This was the most abundant and constant flounder in the markets. Enormous quantities were observed only 6 or 7 inches long. The largest weighed about 15 pounds. Much the largest part of the flatfishes which reach the San Francisco markets is caught by steam vessels fishing with paranzellas off the mouth of Drake Bay.

In addition to fish proper, a very extensive trade is done in other fishery products in the San Francisco markets. In fact, the value of the mollusks, crustaceans, and reptiles which enter into the fish trade of the city is greater than that of the fish. The following products, which constitute all the principal economic aquatic objects additional to fish, were observed in the markets in greater or less abundance:

MOLLUSKS.

Ommastrephes tryoni. *Squid.* Consumed chiefly by the Chinese, although also eaten by natives of southern Europe. On one occasion a Portuguese woman was seen to take a small fresh squid from a counter, bite off its head, and devour it with apparent gusto!

Octopus punctatus. *Octopus; Devil-fish.* Usually exposed for sale by suspending from hooks in the stalls or at the doors of markets. Eaten by Chinese.

Ostrea rufa. *Native Oyster; California Oyster.* Sells for $3 to $4 per bushel. The flavor is "coppery," and the oyster can not be relished by one not accustomed to it.

Ostrea virginica. *Eastern Oyster.* The annual sales are over 100,000 bushels, valued at about $4 per bushel. The supply comes from San Francisco Bay, and depends wholly on seed and plants brought from the East.

Tapes staminea. *Hard Clam.*

Mya arenaria. *Soft Clam.*

Modiola capax. *Mussel.*

CRUSTACEANS.

Cancer magister. This was the only crab seen in the markets. It weighs from 1 to 4 pounds, the average being 1½ or 2 pounds. Next to oysters, it is the most valuable of the invertebrate products. The annual sales amount to 1,200,000 to 2,000,000 crabs, having a value of 5 to 7 cents each. The supply is largely from San Francisco Bay.

Panulirus interruptus. *Crawfish; Lobster.* Reference to the spiny lobster will be found in a separate chapter. The name crawfish, by which this is often called, is an unfortunate misnomer.

Crangon franciscorum. *Shrimp.* The sales of shrimp in San Francisco are very large, and have increased of late years. At the present time the shrimp is, next to the crab, the most valuable crustacean entering into the city's supply of water food, and is exceeded in value only by oysters, soft clams, and crabs. In 1888 Mr. Wilcox found that 290,000 pounds of fresh shrimp, worth $23,200, or 8 cents a pound, were sold in the markets; in 1893 Mr. Alexander ascertained that the receipts amounted to 825,000 pounds, valued at $41,250, or 5 cents a pound. As is well known, the shrimp fishery is in the hands of the Chinese, who, in addition to selling large numbers in a fresh condition, dry and ship to China much larger quantities.

REPTILES.

Rana pretiosa. *Bullfrog.* This animal is figuring more conspicuously in the San Francisco markets each year, and already has great commercial value. The ruling price is $3 to $4 per dozen, and the annual sales amount to between 5,000 and 10,000 dozen.

Chelopus marmoratus. *Terrapin.* Between 1,000 and 2,000 dozen are sold annually in San Francisco, at $3 to $5 per dozen. The supply comes chiefly from the marshy regions at the mouth of the Sacramento River.

Chelonia virgata. *Sea Turtle; Green Turtle.* Reaches the San Francisco markets from the southern coast and Lower California.

THE PACIFIC WHALE FISHERY.

The principal whaling port in the United States is now San Francisco. Besides having a numerous home fleet, that city is the rendezvous of a large number of New Bedford vessels. The growth of the whaling industry on the west coast has been due to the scarcity of whales in the Atlantic and their abundance in the North Pacific and Arctic oceans. The present importance of the whale fishery carried on from San Francisco is largely due to the extensive use of steam vessels, which are considered essential for the proper prosecution of the business in the more northern latitudes.

The year 1893 was the most successful one in the history of the Pacific whale fishery. The San Francisco fleet killed and utilized over 350 whales, of which 294 were bowheads, a much larger number than had been obtained in any previous year. The quantity of bone represented by this catch was 404,600 pounds, valued at $1,246,168; and 6,740 barrels of oil, worth $93,160, were extracted.

The fleet consisted of 46 vessels, of which 20 were sailing craft and 26 were steamers. Eleven of the sailing vessels took 16 bowhead whales and 9 took none, the season for this class of vessels thus being a failure.

The year was remarkable for the remote grounds frequented by the steamers, and the abundance of whales there found. While none of the sailing vessels ventured east of Point Barrow, owing to the ice and fog, a large part of the steam fleet did so, going as far as Herschel Island, Cape Bathurst, and Banks Island. Four steamers, which had wintered at the north of the Mackenzie River, took 94 whales off Cape Bathurst, where they went in July. Returning to the vicinity of Herschel Island, they were joined by 9 steamers from the west, and this fleet of 13 vessels took 164 whales by the middle of September, 1893. Ten vessels that went to Okhotsk Sea and Bristol Bay captured 15 whales, 2 obtaining nothing.

The present aspects of whaling in the Pacific are thus referred to by the San Francisco *Call:*

> The whale is destined to disappear from the North Pacific much more speedily than he was driven from the eastern approaches to the Arctic. The whale fleet sailing out of the port of San Francisco has this year caught in Arctic regions no less than 353 whales. The product of this season's catch would have been represented by about $2,000,000 had prices remained as they were about three years ago. When one small steamer takes 62 whales in a single season, and a still smaller one kills 64, there

is a striking illustration of what steam is doing for the extermination of the whale in the Pacific. There will be no restriction. The whale fishery by sailing vessels has for some time been unprofitable. What the sailing craft would not do in a lifetime of years the steam whaler will pretty effectually accomplish in a very few years.

MINOR NOTES.

A LARGE SKATE.

At Astoria, on June 20, two salmon gill-net fishermen brought in a very large skate, which had become entangled in their net at the mouth of the river. It was landed at a cannery, and was said by a number of people who saw it to have been the largest skate ever landed in Astoria. Its greatest width was 5 feet, its total length was a little over 6 feet, and its weight was 150 pounds. A Chinese salmon-dresser was engaged to open the fish; its alimentary tract was found to contain a number of crabs (*Cancer magister*), some of which were almost whole. The Chinese cannery hands watched the evisceration of the skate very intently, and when the opportunity came hastily made off with the intestines, which are, by them, considered a great delicacy. From a sketch made of this skate and an examination of the teeth the specimen has since been identified as the big skate (*Raia cooperi* Girard). It is the largest representative of the genus on the Pacific coast, and is said by Jordan & Gilbert to have an egg case nearly a foot in length. According to those authorities, it is abundant from Monterey to Sitka.

FISH IN LOS ANGELES MARKET.

At Los Angeles, on June 5, the following meager representatives of the rich fish fauna of the coast of Los Angeles County were seen in the market, which is supplied by the fishermen of San Pedro:

Seriola dorsalis. *Yellow-tail.* One fish weighing 25 pounds.
Orcynus alalonga. *Albacore.* One weighing 25 pounds.
Sarda chilensis. *Bonito.* Two having weight of 8 pounds each.
Halichœres semicinctus. *Kelpfish.* Several weighing about a pound each.
Sebastichthys, species. *Rockfish.* A number of these fish, belonging to several species, were on sale.
Leptocottus armatus. *Sculpin.* A few.
Paralichthys californicus. *Halibut.* Several.
Oncorhynchus chouicha. *Salmon.* A few from San Francisco.
Microgadus proximus. *Tomcod.* Common.

Some anchovies (*Stolephorus ringens*) prepared as "Russian sardines" were also seen.

FRESH-WATER CRAWFISH.

The business of taking crawfish for market is of very recent origin, and their utilization is as yet limited. Several species of the genus *Potamobius* are found in the west coast States, but they are taken only in a few localities. They may be seen exposed for sale in San Francisco and Portland. They are especially numerous in the sloughs of the Columbia and Willamette rivers, from which the greater part of the supply is now drawn, although they occur in great abundance in suitable situations throughout this region. On June 18 several hundred remarkably large and fine-looking crawfish were seen at a fish-stand in Portland. Some were somewhat over 6 inches in body length.

The *Oregonian* of June 19 stated in regard to the crawfish trade of that city:

The first shipment of big crawfish from down the river was received here yesterday, and some of them were whoppers, at least 6 inches in length. They look more like young lobsters than ordinary crawfish. There is quite a demand for these crustaceans, now that the Americans have begun to learn what the French and Germans have long known—that they are delicacies. There is no end of them in the Columbia and Willamette, where they grow to large size, and smaller ones are found in nearly every stream in the State. Quite a business is done by several persons in shipping cooked and spiced crawfish to San Francisco, where there is a great demand for them, and they are now found regularly on the bill of fare at a number of restaurants. It is not likely that there will ever be so many millions of dollars in the crawfish fishery as in the salmon, or even in the sturgeon and shad, but it can be made to yield a profit to many fishermen.

Mr. A. B. Alexander, of the Fish Commission steamer *Albatross*, found that in 1893 the quantity of crawfish received by Portland dealers was 25,000 dozen, with a value to the fishermen of $3,000, or 1 cent each.

FISHES OF MONTEREY BAY AND VICINITY.

The mounted collection of fishes of Mr. B. C. Winston, of Pacific Grove, has already been referred to. The collection is interesting in that it is a fair representation of the fish fauna of a definite part of the coast, being made up from specimens drawn almost exclusively from the immediate vicinity of Monterey; that is, from Monterey Bay and the adjacent ocean. Mr. Winston has courteously supplied a list of the fishes, which discloses some interesting species and seems worthy of presentation.

Polistotrema stouti. Hagfish.
Heptranchias maculatus. Seven-gilled shark.
Catulus uter. Puffy shark.
Triakis semifasciatus. Leopard shark.
Carcharinus glaucus. Blue shark.
Alopias vulpes. Thresher shark.
Lamna cornubica. Mackerel shark.
Squalus acanthias. Dog shark.
Rhinobatus productus. Shovel-nose shark.
Raia inornata. Skate.
Raia stellulata. Skate.
Myliobatis californicus. Stingray.
Alepidosaurus borealis. Lance-fish. Rare.
Synodus lucioceps. Lizard-fish.
Exocœtus californicus. Flying-fish.
Siphostoma californiense. Pipefish.
Hippocampus ingens. Sea-horse. Rare.
Sphyræna argentea. Barracuda.
Scomber colias. Mackerel.
Sarda chilensis. Skipjack.
Trachurus picturatus. Horse mackerel.
Seriola dorsalis. Yellow-tail.
Girella nigricans. Kingfish.
Ditrema laterale. Blue perch.
——— ———. Surf-fish.
Caulolatilus princeps. Whitefish.
Hexagrammus decagrammus. Sea trout.
Ophiodon elongatus. California cod.
Anoplopoma fimbria. Black cod.
Sebastodes paucispinis. Boccaccio
Sebastichthys flavidus. Yellow-tailed rockfish.
miniatus. Rasher.
ruber. Red rockfish. Very rare.
constellatus. Spotted corsair.
maliger.
nebulosus. Garrupa.
serriceps. Treefish. Not common.
nigrocinctus. Black-banded rockfish. One specimen.
goodei.
Sebastolobus alascanus. Alaska rock-cod. Very rare. Two specimens.
Icelinus quadriseriatus. Sculpin.
Enophrys bison. Scorpion-fish.
Nautichthys oculofasciatus. Sculpin. Four specimens.
Rhamphocottus richardsoni. Ramfish.
Porichthys margaritatus. Midshipman.
Neoclinus satiricus. Batfish. Rare.
Clinus evides. Blenny.
Xiphister mucosus. Blenny.
Cebedichthys marmoratus. Crested blenny.
Anarrichthys ocellatus. Wolf-fish.
Microgadus proximus. Tomcod.
Hippoglossus hippoglossus. Halibut.
Lepidopsetta bilineata. Sole.
Pleuronectes stellatus. Rough-jacket flounder.

19.—FEEDING AND REARING FISHES, PARTICULARLY TROUT, UNDER DOMESTICATION.

By WILLIAM F. PAGE,
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ARTIFICIAL FOOD.

In the summer of 1893 I presented a paper at the Chicago meeting of the American Fisheries Society under the title: Plant Yearlings Where Needed. A portion of the paper contained a summary of some studies which I had made on feeding and rearing fishes. The present paper is an elaboration of that summary by adding the results of further study and investigation.

To the fish-culturist striving to improve methods and results the importance of the question of fish food can scarcely be exaggerated. Aside from the interest on the cost of the plant and pay of the necessary employés, it is the principal fixed charge, and in most cases the only item of expense capable of reduction, or, what amounts to the same thing, the most promising field for obtaining better results for the outlay.

I address myself particularly to those fish-culturists who are engaged in rearing fishes to be sold for food, and to those who see the necessity for planting large fish in certain waters intended to be stocked. The paper will have little interest for those who dispose of their fish as fry. To the former class the data, if not the deductions, must possess some value.

Nowhere in the literature of fish-culture obtainable at the general book stores can the prospective investor find an answer to the natural question, How much will it cost to raise a pound of trout? unless we except the statements made in the concluding chapter of Domesticated Trout, a part of which was written twenty-two years ago, and the remainder in 1890, statements which, I think, Mr. Stone would not care to guarantee to-day.* In 1864 Mr. Francis Francis wrote:

> Doubtless some kinds of food agree with them [trout] far better than others. But we know very little on this branch of the subject. It is dreamland to us, with very little ascertained waking reality. Few experiments of any note have been tried in the feeding of fishes, this being as yet almost untrodden ground.

This remark is as true to-day as when written, thirty years ago, and stands as a monument to the want of progress among American fish-culturists. I say American fish-culturists, for fortunately the Europeans have progressed in this direction. Because over two decades ago a fish-culturist, groping in the dim light of a closely shuttered house illuminated by a single bull's-eye lantern, killed his trout with a diet of milk curd, and another expert, with as much (or as little) light in the house and on

* In the Transactions of the American Fisheries Society for 1892, Mr. F. N. Clark presents some calculations on the cost of raising yearling fish, and in the United States Fish Commission Bulletin for 1893, page 228, Mr. C. G. Atkins gives some similar data; but neither of them reduces the cost to pounds of fish, without which, for the purposes of this discussion, the data possess little or no value.

the subject, killed his fry with the yolk of hens' eggs, the law was laid down, "You must not use curd or hens' eggs for fish food," and these two really valuable articles were placed on the blacklist. Unfortunately, with all our vaunt of being the most advanced of the world's nations in fish-culture, we are so conservative that it rarely happens that an article which once finds itself on the list of prohibited foods receives a second trial. As a matter of fact, one of the best experts in the world to-day, one who makes the business pay a handsome return on the money invested, Sir James Maitland, of Scotland, as far back as 1878 was using fifteen dozens of hens' eggs daily. Again, one of the State fish commissions west of the Mississippi River depends largely upon curd as a trout food.* Their work will be shown to compare favorably with that of other places where these cheap articles are interdicted.

Another article proscribed by one of the books on fish-culture is to-day almost the sole food of one of the best-paying private hatcheries in America. These instances are stated to show that the rules laid down in the text-books are not in all cases reliable, having been too frequently drawn from a single illy conducted experiment. Scarcely any of the writers have anything to say on the really important question, How much food is required to produce a given result? Nowhere in the English books are data and rules given which would enable one to calculate with any degree of exactness the amount of food needed during a given period for a given number of fish. One important use of such knowledge would be the calculating of a periodic supply of food for some hatchery situated away from the lines of easy and cheap transportation. Should the feasibility be demonstrated of the preparation, at the base of cheap supply, of an artificial food to be preserved and shipped in large quantities by freight to off-lying hatcheries, the question would naturally arise, How much will be needed during the next six or twelve months? The early experimentalists contented themselves with saying that such and such things made safe, cheap, and economical foods (in nearly every case having reference to liver, heart, and lungs of animals), and that such and such were poisonous to the fish, and quietly ignored the question of definite quantities.

The fact is that there is scarcely an article in the entire gamut from curd to horse-flesh that may not be fed to trout with perfect safety. The questions are, or should be: What amount per day of a given article will be needed to produce a pound of trout within a given time? Is this amount of food beneficial or harmful to the correct or normal development of the fish? If harmful, can it be rendered harmless by the admixture of other foods? And, finally: Can the grower for the market find a profit?

In my Chicago paper it was stated:

> There are among fishes, in common with other animals, several dietaries, some followed from a matter of choice, some from necessity, and others from ignorance on the part of the attendant. They may, for convenience, be thus classified: First, bare subsistence diet, merely sustaining life and resulting in stunted, deformed fish, or starvation; second, healthy diet, promoting normal growth and development; third, fattening diet, fitting for heaviest marketable weight; and, fourth, over-fattening diet, causing a temporary or permanent suppression of the functions of the reproductive organs, a partial or total destruction of the eyes, and inflammation of the intestines, frequently resulting in death.

A considerable percentage of American fish-culturists are to-day confining their stock to the first diet, either in quantity or quality of food, and are yearly producing stunted or half-starved fry which, by courtesy, are called yearlings. Dismayed by their own early experiences and those of the first experimentalists in feeding fishes, they have not only stricken article after article from the list of available foods, but

* Practical Trout Culture, Dr. Slack, page 123: "Curd is absolutely poisonous."

have reduced the quantity below the point of healthy development. One of the early writers has said, with every appearance of correctness, that if the fry are starved in infancy they become stunted, the bones harden, and afterwards no amount of feeding will cause them to expand sufficiently to permit of growth. Unquestionably, it is at this stage in the rearing of fishes (the earliest feeding of the fry) that the greatest amount of damage is possible and the most lasting hurt frequently done. It is the most difficult stage in feeding and rearing, because it is at this point that intelligence and fidelity are needed more than at any other time.

In the first feeding of fry it is not practicable to weigh the fry or their food so as to instruct the caretaker as to the allowance of food; though after the fry have been taking food for some little time it is possible to determine their weight, but it is scarcely probable that any except the most careful experimentalists will ever expend the time and labor necessary. It is not likely that any better method for this determination will be devised than that of Mr. Charles G. Atkins, of the U. S. Fish Commission. His method is as follows:

> The fish are first gathered in a fine, soft bag net, commonly one made of cheese cloth, and from this, hanging meanwhile in the water, yet so that the fish can not escape, they are dipped out a few at a time in a small dipper or cup, counted, and placed in a pail of water or some other receptacle. This counting is generally preliminary to weighing, and in this case the fish after counting are placed in another bag net, in which they are lowered several hundred at a time into a pail of water, which has been previously weighed, and the increase noted. With care to avoid transferring to the weighing pail any surplus of water, this is a correct method and very easy and safe for the fish.—(Bulletin of the U. S. Fish Commission, 1893, p. 227.)

Mr. Atkins does not say so, but it would seem that he must deduct from the increased weight the weight of the wet bag net immersed in the weighing pail.

Only judgment, experience, fidelity, and watchfulness on the part of the attendant charged with the feeding will be found to answer at the time when the fish first commence to take food; and unless these qualifications are employed the fish are either fed to death or starved. Some of the rules for feeding young fry would be laughable if it were not for the memory of the helplessness of the fish. A rule at one hatchery is to give them all they will hold; another acquaintance says keep them hungry all the time. There are few happy mediums in practice. Years ago the idea was disseminated that any clever youth of ordinary capacity could safely be intrusted with the care and feeding of fishes. Unfortunately the idea is not yet entirely eradicated. They are short-sighted managers, blind to the principles of protection of animals from cruelty, who leave this most important branch of the work in the hands of any except the patient, intelligent, skilled workman.

Not all cases of semistarvation and stunting have resulted from the causes mentioned—ignorance or fear on the part of the attendant. Cases have fallen under my observation where, from various causes, the desired food, either as to kind or quality, was not obtainable. Again, some fishes, particularly brook-trout fry, will persistently decline the most dainty and delicately prepared foods. My own opinion is that when a lot of fry is found acting in this manner the best thing the culturist can do for himself is to get rid of them at an early day. They will never make fine fish. * Several reasons have been advanced to account for this peculiarity on the

* In this connection the question presents itself: May we not from this find a possible reason why in certain streams, presenting a fair abundance of food, we never find trout above fingerlings in size. I, of course, suppose that in nature, as well as in artificial fish-culture, there are cases where the young, from some cause, will not eat, and it is more than probable that in many lots of fish hatched naturally a large percentage never find any food, or find it too late to prevent or arrest the stunting process. Once stunted, always stunted.

part of certain lots of trout, none of which are entirely acceptable. One writer* asserts that at the time of the absorption of the sac the fry rises in search of natural food, and if he does not find it he is compelled to take the artificial food prepared for him, and the difficulty of adapting his stomach to this food results in a loss which varies from 50 to 75 per cent.

Another fish-culturist says that they fail to assimilate the artificial food and die. In passing, I hope to be pardoned for asking if the trout fry in the feeding troughs offered artificial food when nature demands an aliment, even granting for argument that they can not always assimilate it, are not in better position to fight the battle of life than the trout fry in the streams, either hatched or planted there, where they too frequently find an entire absence of food, for we know that streams are as frequently barren of natural food for trout fry as the streets of cities are barren of food for children. They live and reach a certain phase of maturity, but the product too often falls short of expectations.

At one large establishment where the yearling fish have for a number of years been abnormally small the trouble is thought to be due to prevailing low temperature of water. This, in a measure, may be true, for it is a generally accepted opinion that trout will not readily take their food on cold and cloudy days, and it is not unreasonable to suppose that the same cause would prevail in water of a constantly low temperature. My own observations lead me to believe that, outside of the spawning season, properly trained trout will eat as greedily during a snowstorm as during fair weather.

To whatever cause due, it must be admitted by every candid and impartial observer that thousands of trout are annually raised which in size fall short of a commensurate return for the time, interest, and money expended. I hope to show that a partial correction is possible by the use of an adequate quantity of proper food. Private fish-culturists, selling yearling fish at so many dollars per thousand, are more than any others interested in making this correction. Information is beginning to be disseminated on this subject, and the purchaser, who a few years since was willing to pay fancy prices for that most meaningless and illy defined of all salable products—yearling trout—is now commencing to ask, "Of what size are the fish?" It seems to me that it would be rational and fairer to all parties to establish a weight per thousand and grade the prices up or down as the weight rose above or fell below the standard.

The importance of making such correction as above suggested is apparent, for if at times we are stocking streams with stunted fish we are antagonizing one of the hopes and claims of fish-culture, namely, the improvement of existing species. I care not how carefully the breeders may be selected, how minutely all the essentials of impregnating, hatching, and transporting receive attention, the resulting adult fish will never be of large size and fine quality unless the fry have been properly fed; and it is probable that if these fry have been stunted their progeny will be stunted. The progressive and enlightened cattle-breeder looks closely to it that those individuals which are to perpetuate his herd have received proper feeding and acquired full and normal development; and if by chance a runt is among the herd, it is set apart from the breeders. For the same reason we should not allow stunted fishes to enter into the brood stock or into streams.

Against the danger of under feeding there should be little cause to warn the culturist engaged in growing for the market. But because I have known such cases,

* Mr. Herschel Whitaker, Trans. American Fisheries Society, 1892, p. 96.

the warning is distinctly given to the private fish-culturist. The greatest drawback against raising large trout in a given time (possibly surpassed by an improper selection of breeders) is an improperly prepared food given in starvation rations to the fry. "As the animal is, so to speak, made during its early age, and as during this period its assimilating organs acquire their strength and their power of absorption, a young fish which is insufficiently fed not only grows very slowly, but will never become a fine fish."* Time was, and unfortunately is yet with too many, that cannibalism was the only danger feared from fry on short rations. Cannibalism was a very good bugbear, but the true danger does not lie there, as it is always capable of correction in a short time.

The discussion of the second and third diets mentioned will be passed over for the present and we will proceed to look at some of the ill effects of the fourth, overfattening diet, "causing a temporary or permanent suppression of the reproductive organs, a partial or total destruction of the eyes, and inflammation of the intestines, frequently resulting in death." Nearly every fish-culturist of experience has seen the two latter evils, "pop-eyes" and "inflamed intestines;" whilst many have observed, without knowing the cause, the retardation of the genital organs of the fishes. It seems fairly probable that the causes known to affect the breeding of other animals will in like manner influence the breeding of fishes. It is a recognized principle among stock-breeders that an overrapid accumulation of fat is followed by partial or total sterility, just as conversely a removal of the genital organs is always followed by a rapid accumulation of flesh. It would seem that the two processes are intimately connected, and that an excess in either direction is at the expense of the other. The complaint has not infrequently been made: "My fish grew finely, attained a remarkable growth, and I fully expected a large number of eggs this season, but got very few." It rarely or never occurs to such complainants that the want of eggs was due to the exceptionally fine growth. I have in mind a hatchery where the growth of brook trout was such that many of them lost their eyes. Eggs were obtained in fair quantity, but they were of such low degree of vitality that the season was counted a failure. When these fish were marketed their quality was graded low. More than twenty years previously Dr. Slack had noted a similar occurrence. In his book (Practical Trout Culture, p. 121) he recounts the following:

> A wealthy gentleman of a neighboring State constructed a well-appointed fish farm, with well-stocked ponds. To his surprise, during the spawning season but few eggs could be obtained and but a small percentage of these could be impregnated. We were consulted in regard to the matter, and our first look at his fishes showed us plainly the cause of the trouble. The fishes were enormous, the bodies greatly swelled, the whole cavity of the abdomen being filled with layers of fat. It appeared that the proprietor had for over a year fed them twice a day all they could eat, and the result was, as might have been expected, barren and unhealthy fish.

If ever artificially reared trout sell on a parity with wild trout—and there is no reason why they can not be made to do so—it will not be the overfed, pop-eyed, liver-reeking fish, which will produce the result. The danger of overfeeding is just as distinct and as much to be avoided as that of underfeeding, though obviously the evil effects will be less lasting and more restricted in results.

Let us now turn to the second classification, "healthy diet, promoting normal growth and development." By healthy diet I mean not only the proper amount of food per day, but a food composed of proper constituents. It has been before inti-

* C. Raveret-Wattel; U. S. Fish Commission Bulletin, 1887, p. 210.

mated that the writers on fish-culture have been vague in dealing with this subject. A few quotations will serve to make this point clear:

This quantity varies with the season, the quality, the quantity, and temperature of the water, and other circumstances, and can not be stated definitely.—(Domesticated Trout, Livingston Stone, p. 236.)

Under favorable circumstances 5 pounds of meat food may be considered an equivalent for a pound of trout growth, with 2 and 3 year olds. For any given quantity of 2 or 3 year olds 1 per cent of their weight may be regarded as an adequate average daily ration the year round. Two and three year olds will double their weight annually, and can be made to do so in the six months from May to September by extra care and feeding.—(Domesticated Trout, p. 265.)

As to the quantity of food necessary for a given number of trout. This is difficult to give exactly, as it will vary with the size of the fish and the season of the year, more being required in moderate weather than when it is very hot or cold. For 1,000 three year-olds, about 5 pounds of liver or lights per day.—(Trout Culture, Seth Green, p. 51.)

When six months old a bowlful of curd, diluted with water, will answer for 1,000 trout fry.—(Trout Culture, Seth Green, p. 38.)

Since our stock of fishes attained its present size we have never been able to obtain as large a supply of food as we would desire ; yet we find that our stock fishes, weighing in the aggregate about a ton (2,000 pounds), thrive upon 50 pounds of lights a week, fed them in equal proportions on alternate days. As an average 50,000 young will require, when 6 months old and well supplied with maggots, about a pound of chopped heart thrice weekly, though the amount varies greatly.—(Practical Trout Culture, Dr. J. H. Slack, pp. 121 and 125.)

The quantity of food required is also large (for 2-year-old trout). Three pailfuls of chopped horse are given daily to pond 15, which yields from 20,000 to 22,000 each season. The food is measured, not weighed, but each pail holds 14 pounds.—(History of Howietoun, Sir James Maitland, pp. 73 and 74.)

When trout are raised in ponds of the dimensions I have given it is evident that little or no dependence is to be placed on natural feed, such as flies and their larvæ. Hence the necessity of providing curds or liver and lungs of animals, at prices that will not cause too great an expenditure for the value of the crop. I have found that the curd from the milk of one cow, which gave 14 quarts, would feed bountifully 1,000 or 1,200 trout averaging five-eighths or three-quarters of a pound, the smallest being 7 inches long and the largest from 2 to 3 pounds in weight.—(American Fish Culture, Thaddeus Norris, p. 74.)

These quotations, carefully selected as the expressions of the five most generally read English writers on fish-culture,* show how little definite and accurate information is recorded on the vital question of what should constitute a proper ration for a given number of trout. Sometimes the number of fish is stated, sometimes their age, in one instance the approximate weight is given, and only one English writer has had the courage to approach scientific accuracy. But, alas! His formula is made to apply only to fish 2 and 3 years old. The fry and the fish more than 3 years old are not provided for.

The amount of food necessary for the maintenance in good health of a given lot of fish must, as with any other animals, be in direct ratio to their weight, not their age.

* From writers of other nationalities the following quotations may be acceptable:

By experiments M. Lugrin has ascertained that a basin * * * may contain 20,000 young fish from 8 to 12 months old, or 3,000 two-year-old trout having an average weight of 250 grams ($\frac{11}{20}$, or a little more than one-half pound). These 20,000 young fish, or 3,000 trout, consume about 22 pounds of small shrimps per day.—(The Piscicultural establishment at Gremaz, France; by C. Raveret-Wattel, Bulletin U. S. Fish Commission, 1887, p. 209 et seq.)

At Howietoun it is on the weight (one-fiftieth of the living weight) that is determined the food to be given, a method which appears more scientific and at the same time more practical than that of feeding them without regard to age or development.—(Notes of M. Després, proprietor of the fish-cultural establishment at Nanteuil-en-Vallée, France.) [I have not been able to find this formula of one-fiftieth of the living weight anywhere in the History of Howietoun, and I suppose that M. Després must have received the information privately. I am fully in accord with M. Després in his criticism on the value of this formula.]

To state that 20,000 fish require three buckets of food per diem, without stating the weight of the fish, is insufficient.

One of the first things to impress itself upon the attention of the student of this question is the wide and almost unaccountable variation in the size and weight acquired by fishes of the same species under different hydrographic and climatologic conditions. In some instances this variation amounts to 700 per cent. Compare the weights of yearling trout raised in Colorado and Missouri. Who would say that 1,000 of the Missouri trout should be restricted to the same daily rations as a like number of like fish in Colorado? Elsewhere I have said that the Colorado trout could not consume the allowance of the Ozark (Missouri) trout, and that the Ozark trout would stunt or starve on the Colorado allowance. Better results will be obtained when fish-culturists realize that fishes must be properly and plentifully fed in their infancy and that their allowance of food, regardless of age, must be in constantly ascending ratio with their increasing weight.

In the first study of this question I early found the lack of definite data in the English writings. Correspondence was instituted to ascertain the general practice. For convenience of comparison and study a condensed tabular statement of the replies received is here presented:

Food and growth of trout.

Name and location of establishment.	Elevation above sea level.	Mean annual temperature of water.	Average daily rations, in pounds, per 1,000 yearling trout.	Character of food.	Natural food present in ponds.	Length of average yearling trout.	Weight per 1,000 average yearlings, in pounds. Brook.	Rainbow.	Lake.	Von Behr.	Loch Leven.
		° F.				*Inches.*					
Solway, Scotland	150	50	1.16	Animal	Yes	2.5 to 6	No tests made.				
Howietoun, Scotland	300	50	.66	do	do	3.5	No tests made.				10
Guilford, England		50	v'ry sm'll	do	Abundant	4 to 10	50			50	50
Haslemere, England	200	49–56	do	do	do	4 to 10	50			50	50
Vivero, Mexico	7,600	57	4	do		6 to 7		140			
La Condesa, Mexico	6,500	68–70		do	No	7 to 8		160			
Cold Spring Ponds, N. H.	500	35–76		do	None	6 to 7	130				
Troutdale Farm, Ark	600	59.5	2.5	$\frac{1}{7}$ anim'l $\frac{6}{7}$ veg.	Abundant	7 to 10		250			
Willow Brook, Minn	685	46.5	10	Animal	do	5	75	80	150	80	
Annin's Hatchery, Caledonia, N. Y.	690	48		do	Some	3.25	† 15	† 15	† 20	† 15	
Old Colony, Plymouth, Mass.	50	50	7.5	do	Im'nse qu'n'ty	6	‡ 90			‡ 90	
State Hatchery, Nevada	4,660	45		do	Yes	6	No tests made.				
State Hatchery, Nebraska.	1,100	50	.5	do	Limited	4.5	50	50		50	
Duluth Station, U. S. F. C.	602			do		5	70	80	140	80	
Leadville Station, U. S. F. C.	9,640	36.3	.12	do	Considerable	2.5	10			6	
Northville Station, U. S. F. C.	600	44.3	.14	do	Scarce	4 to 6	§ 60	§ 80		§ 40	
Wytheville Stat'n, U. S. F. C.	2,300	53	.47	do	do	4.5		60			
Neosho Station, U. S. F. C.	1,041	58	1.87	$\frac{2}{3}$ veg. $\frac{1}{3}$ anim'l	do	5.5	75	51.8			

* This weight was for fish 15 months old. My experiments in the spring of 1883 demonstrated that rainbow trout increase their weight enormously in the fourteenth and fifteenth months. In proportion to the increase at Neosho the Troutdale (Mammoth Spring) trout, at 1 year old probably weighed 82.27 pounds per 1,000 fish.

† Mr. Annin says: "I have been very careful that my answers have been correct, and not magnified."

‡ These answers are given as of May 1. I should say that the fish were yearlings past, and, judging from the length of the fish, very highly fed.

§ Determined by the weights of specimen fish furnished to be cast for the World's Fair at Chicago. Fish furnished by the Neosho station for the same purpose ran 330 pounds for brook, 200 pounds for Von Behr, and 140 pounds for rainbow trout (per 1,000 yearling fish).

The difference in locality, elevation above the sea, and mean annual temperature of the water at the hatcheries is quite varied, but not more so than the daily rations given. As for the results—the weight of the yearling fish—the data as given do not admit of a too close comparison, some of the fish having been weighed at 10 months old and others at 15 months old.

However, a study of the table does show that there is not only a decided lack of harmony between the practice or methods of feeding followed at the various establishments, but that some are giving an inadequate quantity of food and others are feeding far in excess of the needs. For instance: Leadville Station gives but 2 ounces of animal food per day per 1,000 yearling trout, while the Willow Brook Hatchery, of the Minnesota Fish Commission, gives eighty times as much to the same number of fish. The quantity of food used at the Leadville Station is the smallest for which I have any return, and it is not surprising to find that the fish grown there are smaller than at any other hatchery in the United States. The next smallest is the Howietoun Fishery, of Scotland, where the ration is but two-thirds of a pound and the weight of 1,000 yearling fish (Loch Leven trout) but 10 pounds.

When the very small size of the fish produced at Leadville first came under my notice I was of the opinion that the extreme altitude of the place might in some way (possibly by reason of the low temperature of the water consequent upon such great elevation) be a controlling factor in producing such a slow growth. So firmly was this idea fixed, that when the returns from the Mexican hatcheries were received I requested a retesting of the weights. Not only was the weight as first given corroborated, but a sample of the food used was furnished. In that sample of food, "mosquitte" (*Coriza femorata*) was found the secret. It was a correct food, unfortunately at present beyond the reach of American fish-culturists.

Seeing, then, that the laws of the text-books and the general practice are so variable, vague, and unsatisfactory, let us see what may be determined by analogous reasoning from the established laws of dietetics for other animals.

Before entering upon this branch of the subject the reader is requested to bear in mind that fish are cold-blooded and will never need—in fact, would be overburdened with—as large a proportion of heat-producing foods as are needed by the warm-blooded animals. Being cold-blooded, they have no body temperature to maintain, and so do not require in so large a degree the rich hydrates of carbon needed by the warm-blooded animals. Again, in small ponds, where the very largest per cent of the food is supplied artificially, the work of the fishes in procuring a livelihood is reduced to a minimum, and this will also be found a factor in determining the character of the food to be supplied.

Animals for which laws of dietetics have been established most nearly resembling the condition of fishes under domestication are cattle and men not at work. But no perfect parallel can be drawn between these classes on account of the body heat to be maintained on the one hand and its absence on the other. It seems that the average man, passive or at lightest work, requires, according to the various authorities, solid substances ranging from 20 to 44 ounces per day.* Assuming the average man to weigh 130 pounds, the average of the allowance of the authorities would be $1\frac{1}{2}$ per cent of the weight of the man. Dr. M. G. Ellzey, formerly professor of agriculture at

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* Billings's National Medical Dictionary, p. XXXIX; Flint's Text-Book Human Physiology, pp. 191, 192; Marshall's Outlines Physiology, p. 899.

the Virginia Agricultural and Mechanical College, is my authority for saying that "about 1½ per cent dry food substances of the live weight is reckoned good keep for mature live stock."

It will be noticed that these allowances are for dry substances only. In an attempt to make a comparison between the food allowances for men and cattle and fishes the liquid substances have purposely been omitted. This is impossible of calculation for the fishes. It will vary constantly with the character of the water, the soil over which it drains, and the season of the year. It may roughly be assumed that the sustaining elements of the coffee, tea, milk, etc., entering into the food of the warm-blooded animals is replaced or compensated for by the insect life present to a greater or less extent in or over most waters.

A study of the foregoing table and quotations giving the feeding methods followed at the various fish-cultural establishments shows that the average of the food allowance is 6½ per cent of the weight of the trout. Last year I expressed the opinion that this allowance was in excess of the requirements. This judgment was possibly hasty, for it is to be noticed that in every instance the amounts are for wet foods; that is, for liver, meat, curd, etc., in a more or less moist condition. The limited data at my command shows that 1 pound of liver contains 24 per cent of dry substance; 1 pound of horseflesh contains 23 per cent of dry substance, and 1 pound of curd contains 45 per cent of dry substance. From tests I find that 1 pound of mush made from shipstuff, or shorts, contains 28 per cent of dry substance. Hence we would have as the average 2⅓ per cent of dry substance given to fish as against 1½ per cent allowed cattle and men not at work. I think it will be admitted that this is too much. Not only is it contrary to analogy, but the experience of the Neosho Station has proven, to my satisfaction at least, that it is in excess of all requirements. In the year which gave us the highest degree of satisfaction the food allowance was 3 per cent wet substances, or 0.75 per cent dry substances. The trout at one year old in that season attained a length of 6 inches and a weight of 51.86 pounds per 1,000 fish. On page 300 will be found the schedule of the food allowance for these fish during each month of the year reduced to a daily allowance per 1,000 fish.

From the foregoing, and from other observations, I am of the opinion that 1 per cent of the live weight per day of dry substances will be found ample for trout, and that an amount much in excess of this would be prejudicial to the development of the fish. But it must not be supposed that this allowance of any or all substances will be found to produce the desired result. As before intimated, the contrary will sometimes happen. Man could exist but a short time on 1½ per cent of his weight on bread or meat alone. Not only this, but it has been pointed out that all food substances vary, in the quality of their constituents, with the soil and season. No matter how perfect the premises and how careful the reasoning, safe laws of dietetics, for man or fish, will be found to require a great degree of elasticity.

Certain conditions are necessary to make an artificial food generally acceptable. The supply must be convenient and certain; the cost must be such as not to entail too great an expenditure for the value of the crop of fish; it should be a substance of easy and rapid preparation, and, above all, the chemical composition, or proportion of nitrogenous and nonnitrogenous constituents, should be in accordance with the requirements of the fishes to be fed. In determining the food to be used at any hatchery all of these factors must be considered in connection with the conditions of

the local market. The one element of food which has most generally been found to fill these conditions is liver. It was probably the most fortunate accident in the history of fish-culture that the circumstances of the first three conditions forced the attention of the early culturists to liver. Its adoption may be viewed in the light of a lucky accident, for in those days only the first three conditions were recognized, and the fourth and most important condition, the proper combination of the elements with a view to the requirements, was not considered by the fish-culturist. To-day, unfortunately, it is but slightly understood. In substantiation of the view of the value of liver the reader is referred to Prof. E. Wolff's table of percentage of nutritive substances used as fish food.* From this table it appears that the chemical composition of liver (and hearts, lungs, and brains of oxen) more nearly approximates that of insects and their larvæ than does any other article of animal substance which has yet come into use.

In Nicklas's Pond Culture the study of the food for carp is detailed fully. Nicklas deduces the formula that—

> The most favorable proportion of nutritive substances in carp food is Nh : Nfr :: 1 : 0.5 (or 0.6), and that consequently food containing a good deal of nitrogen is the best and most profitable for carp. The most suitable articles for food, therefore, are blood, horseflesh, fish guano, curds, meat dried and ground fine, refuse from slaughterhouses, etc. *All these, however, require to be mixed with other articles of food containing less nitrogen, so as to restore the proper proportion of nutritive substances.* On the whole the food for the carp will have to be mixed very much on the same principle as that for cattle and other domestic animals.

The italics in this quotation are mine. When it is remembered that Nicklas's formula was evolved to apply to the sluggish and slow-breathing carp, and that the main subject of this paper is the active and rapid-breathing trout, the emphasis will be apparent. The very largest proportion of the nonnitrogenous elements of food required by the trout (and it will be very much in excess of that needed by the carp) is for the purpose of respiration. It is for this reason that the otherwise excellent article of liver, when employed alone, has not proven a perfect food for trout; and it is partly from this reason that the Neosho method of mixing a large proportion of nonnitrogenous substance with the liver has secured such satisfactory results.

If the careless reader is inclined to ask, Why is not a food well adapted to one kind of fish (carp) equally well suited to another (trout)? I would remind him that whereas man in the tropics needs but the scantiest quantity of fats and oils the Eskimo requires 20 pounds of animal food daily.† It would be a serious error to suppose that the food suited to carp is equally suited to trout, or that the food adapted to trout living in a mean temperature of 55° to 65° would be the best for the same fish in a mean temperature 30° lower. The very change in the rate of respiration consequent on the change of temperature would, if the feeding was to be done on the most economical and rational basis, entail a change in the character of the food. A consideration of these facts led me some years ago to adopt a mode of feeding trout which has since become known as the "Neosho method." The following description of the method of preparing the food and feeding the fish at the Neosho station may be of interest.

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* Die Teichwirthschaft. From the Lehrbuch der Teichwirthschaft, by Carl Nicklas. United States Fish Commission Report, 1884, p. 467. Translated from the German by Herman Jacobson.

† Second Voyage for the Discovery of the Northwest Passage (Sir John Ross).

FISH FOOD AS PREPARED AND USED AT THE NEOSHO STATION.

The base of the food is composed of a mush made of "shorts," or mill middlings. To this mush, according to the kind of fish to be fed, beef liver is added in varying proportions. The mush, unmixed with liver, is fed to some kinds of fish; mixed with liver to others, and for some kinds is not employed. For making the mush we use the best quality of shorts. The poor quality will not answer, because, like corn meal, the mush made from it is too readily soluble in the water, dividing into finer particles than the fish will eat. To obviate this we have the miller mix from 5 to 10 per cent of poor flour with the shorts when it "runs poor." For making the mush a large, 25-gallon farm boiler is filled nearly full of clean water, which is brought to the boiling point. Shorts is then added, about 1 gallon at a time, and thoroughly stirred in. Care is taken that the shorts does not become lumpy, but has a chance to cook in an even pasty mass, otherwise portions would be raw. After enough shorts has been added to bring the mass to a thick mush it is poured off into convenient-sized pails and allowed to cool. It has been found advantageous to allow the mush to set and harden thoroughly in the pails before using. To aid this process in the summer the pails are placed in the cold running water in the hatching troughs. When thoroughly set, well hardened, it is not so likely to too freely dissolve in the ponds.

To each kettleful, of 25 gallons capacity, 30 pounds of shorts are used, producing 166 pounds of mush. To each kettle of mush, as it is being made, three to four pints of common salt is added. Whilst the shorts is being added to the boiling water the mixture requires constant, vigorous stirring. For this purpose we use a wooden paddle with a handle 4 feet long. Forty-five minutes is usually sufficient time in which to prepare such a quantity of mush.

Four to five minutes will prepare a 10-pound beef liver for our work (except when feeding young fry), by using a No. 22 meat cutter made by the Enterprise Manufacturing Company, of Third and Dauphin streets, Philadelphia, Pa. These machines are provided with perforated plates for regulating the size of the cut of meat. The perforations vary from one-sixteenth to three-eighths of an inch, being ample range from smallest to largest fish, except for very young fry. When trout commence to feed the liver is run through the one-sixteenth inch plate, and afterwards is forced through a fine-wire screen. The screening of the liver is kept up until the trout are large enough to swallow the particles of meat as they come from the machine. This period varies with the development of the fish, the safe period averaging about the third month of feeding.

The very young trout have never been subjected to the mush diet, though it is not doubted that they could be induced to eat it, but they are started and kept upon a pure beef-liver diet until they are thoroughly trained to congregate for their food. When the fry have been on beef liver for about two months we commence to mix in a little mush, and gradually increase the proportion of mush (and quantity of food) until by the time they are six months old the mush and liver may be in equal proportions. After that time the addition is made freely, so that when the fish are yearlings the liver may be reduced to a minimum. Exigencies have arisen making it desirable to economize on liver. At such times we have not hesitated to put the trout on a diet of pure mush. They rise to the surface for this food, sometimes meet it in the air, and rarely or ever allow a particle to reach the bottom. That the fish produced by this diet are normal and healthy is beyond all question, and if evidence is wanted it is to

be found in the fact that their progenitors, spawning them at 2 years old, were raised on the same diet. As yearlings these fish averaged 6 inches long and 51.86 pounds to the 1,000 fish.

The adaptability of the stomach of the trout for various foods was tested by the following experiment which I conducted at Neosho in 1892. On August 9, 1892, 12,000 healthy trout fry, which had up to that time received the same general treatment and allowance of food as we usually give, were deprived of all animal or flesh food. From that time until they were shipped, in February, 1893, not an ounce of animal food was given them, and it is certain that the natural animal food which they might have obtained was the very least. At the end of the year they averaged 4 inches in length, and an average 1,000 weighed 27.5 pounds. The fish were normal and healthy, and though under the average for Neosho, they were above the average of at least two American establishments.

The results to be obtained by this method are intimated above and a comparison of results may be made by referring to the table on page 295.

As to the cost of this method the following table shows the allowance per 1,000 fish from May 1 (about the average time when fry are liberated as such) to December 31. I might state that at the Neosho Station liver costs 5 cents per pound and mush one-fourth of a cent per pound. These prices will, of course, vary with the locality.

Daily allowance of food, in pounds, per 1,000 rainbow trout (Neosho method and practice).

Period of time.	Liver.	Mush.
During May	.07	.30
June 1 to 7	.10	.40
June 8 to 14	.12	.48
June 15 to 21	.15	.60
June 22 to 28	.17	.68
June 29 to 30	.20	.80
July 1 to 5	.20	.80
July 6 to 12	.22	.88
July 13 to 15	.25	1.00
July 20 to 26	.27	1.08
July 27 to 31	30	1.20
August 1 to 31	30	1.20
September 1 to 30	.35	1.40
October 1 to 31	.40	1.60
November 1 to 30	.45	1.80
December 1 to 31	.50	2.00

Calculations from the above table show that the food for 1,000 rainbow trout from May 1 to December 31 (discarding fractions in the totals) amounts to 75 pounds of liver and 300 pounds of mush, costing in the aggregate $4.50. The production for this expenditure averages 50 pounds of trout. The value of this product varies with the market, and is impossible of calculation for any specified period.

In a short article in the United States Fish Commission Bulletin for 1894, pp. 71 and 72, may be found some additional notes on the feeding and rate of growth of trout in their second year at Neosho. By reference to this article it will be seen that 1,500 13-months-old rainbow trout made the remarkable gain of 241 per cent of their weight in ninety days at an expenditure of 5 cents for food for each pound of trout gained. At the end of sixteen months these fish were at the best marketable weight, about one-third of one pound, secured at a cost, for food, of about 7½ cents per pound of fish. This very rapid development of the trout during the latter three months is not peculiar to Neosho. Señor Cházari states that the rainbow trout in Mexico attain a weight of 160 pounds per 1,000 yearlings (!), and that "their development in the latter part of the year is very rapid."

The trout reared at the three hatcheries where the Neosho method of feeding is followed, namely, Neosho, Mo., Wytheville, Va., and Mammoth Spring, Ark., are not surpassed by any in the United States or in Europe. Only at the Mexican hatcheries, where the cheap labor and peculiar conditions enable them to collect and supply the natural food in sufficient quantities, are larger trout grown in the same period of time. In 1893 the method was adopted by Mr. F. N. Clark, superintendent of the Michigan stations of the U. S. Fish Commission.

Stubborn as are the facts which have been presented, the mixed diet for trout has been covertly attacked on the ground that trout, from the nature of their teeth, are carnivorous, and that it is contrary to nature to supply the domesticated trout with other than a purely flesh diet. If our knowledge of dentition ever reaches any degree of exactness it will show exceptions to the general law which will refute such idle talk. It is a fact well known to all careful observers that—

> All our common fresh-water fishes eat vegetable matter. All of them seem to be fond of mulberries and elderberries. Chubs, perch, eels, cats, carp (suckers) eat all grains and the meal thereof, whether whole or ground. I believe that all of the rodentia are at times flesh-eaters. Herbivora often eat flesh. Horses, mules, and cattle eat dry fish-scrap freely. In the case of fishes which scarcely chew, the dentition does not impede a change from one sort of diet to another. The lines which separate between flesh-eaters and vegetable-feeders are scarcely so hard and fast as are generally thought.—(Dr. M. G. Ellzey, ex-commissioner of fisheries of Virginia.)

The dentition argument against the mixed diet for domesticated trout is as reasonable as that of the so-called school of vegetarians, who declare that because our teeth resemble those of the vegetable-feeding apes more than any other animals our most appropriate food is the fruits of the earth. I have before stated that the trout we feed in our ponds are domesticated animals; that the jackal and the wolf are carnivorous, but the domesticated dog sickens and dies when restricted to the only food acceptable to his ancient progenitors. It is strange and unaccountable that the average fish-culturist will persist in basing all his arguments for the determination of the food for fishes under domestication upon the known habits and preferences of the fish in a wild or natural state. All data relating to the habits and food of fishes in nature are of the highest value to the fish-culturist in determining the best conditions for stocking streams, but they have no direct bearing upon what should constitute their food under domestication.

Dr. James A. Henshall presented at the twentieth meeting of the American Fisheries Society (Washington, D. C., May, 1891) a paper on The Teeth of Fishes as a Guide to their Food Habits. In the closing portion of this paper he says:

> Thus, by observing the character and position of the teeth of fishes we have a sure and certain indication of the character of their food, that is, of their principal and natural food. Of course, there will be exceptions, but they only prove the rule. An herbivorous fish will occasionally swallow animal food, while a carnivorous fish will sometimes swallow vegetable matter. * * * They should be judged, however, by what they feed on mostly and habitually when situated so that they can exercise their choice in the matter, for change of environment may involve a change of diet.

The last sentence of this quotation strikes the keynote of a mixed diet for trout under domestication. Dr. Henshall would have come nearer to the facts had he said that a change of environment (and it is a wide change from nature to domestication) frequently demands a change of diet.

In Forest and Stream for November 18, 1893, over the signature of Mr. A. N. Cheney, is the following statement:

One of our best-known fish-culturists told me of his experience in rearing trout for market on mammal food. He said he hauled his liver, etc., to the pond in a two-horse wagon, and carried the trout to market in a basket on his arm.

It is very possible that this misguided brother was one of the best-known fish-culturists, but it is certain that he was not one of the knowing, for, while he was employing two-horse wagon loads of liver to produce basketfuls of trout, other fish-culturists were rearing them on a mixed diet of liver and mush for 8 cents and 10 cents a pound.

On page 49 of Seth Green's Trout Culture is the statement that "trout are carnivorous, and will not eat vegetables of any kind that we have ever tried." This statement, in exactly the same language, is repeated nine years afterwards on page 80 of Fish Hatching and Fish Catching, published in 1879 by Mr. Green and Mr. Roosevelt, commissioner of fisheries of New York. Mr. Green's efforts in this direction could not have been very extended. The trout at Neosho are very fond of crackers (stale oyster crackers), and I have frequently given the fry a treat of boiled potatoes, forced through a masher (C. F. Henis patent, which I regard as superior to Sir James Maitland's feeding spoon), boiled rice, pease, and beans.

There is a statement in Mr. Green's first book (1870) touching the matter of feeding which takes almost the form of prophecy. On page 47 he says:

Trout can be bred to any color by feeding and the use of proper ponds, and we believe that in the future they will be bred to color, shape, flavor, etc., with as much nicety and certainty as the cattle fancier breeds his animals.

At the Vivero hatchery, Mexico, the food consists largely of *Gammarus*, which are there to be had only in a miry marsh. These impregnate the trout with a peculiar muddy or marshy taste. To obviate this trouble the shrimp food is suspended some two months before the marketing of the fish, and nutmeg and ginger is added to the other articles of food for the purpose of imparting an aroma or flavor to the flesh of the trout. If the American palate objects to the combined flavor of nutmeg and trout there is reason to believe that the objectionable article might be replaced by some other flavor more acceptable. It is the writer's opinion that such a condition as prophesied by Mr. Green can not be induced by the use of a mammal diet solely; but Señor Cházari has demonstrated the possibility of flavoring the trout flesh by mixing vegetable with animal matter.

Should it be urged that trout raised on a mixed diet and intended for stocking streams would, when liberated, by reason of a perverted nature and taste, be unfitted for natural food, I may answer by referring to the difficulty of retaining fowls which have been hatched from eggs taken from wild nests. In infancy they live, thrive, and fatten on the farm grains and kitchen scraps of bread and meat. One fine day they leave for the woods or moors. Is it reasonable to suppose that they die for want of the diet which served them so well in infancy? The process of reversion from domestication to nature is always easier than the change from nature to domestication.

Little as is known of the correct rations and best food for fishes under domestication, there is less known (and from the nature of things it will be more difficult to determine) of the very important and high-power factors of range and space in determining the development and rate of growth of fishes. It is well known to every culturist of experience that these are factors which should not be disregarded, and if disregarded neither extra feeding nor additional water supply will compensate for the lacking elements. At first, range and space may seem to involve natural food,

and it must be admitted that to some extent this is so. But it is known that in pools where the natural food is necessarily of a minimum quantity (for if the pool is at all well stocked it can only be that introduced in almost microscopic particles by the inflowing water) a given number of trout would be outstripped in growth by half the number on the same rations per thousand fish. This has been ascribed to exercise, freedom of movement, a larger quantity of oxygen per fish, and various other causes.

Other things being equal, it is certain that the temperature of the water and the proportion of the pond or pool subject to renewal each minute, or hour, will be found controlling factors of no small consequence. Of course, these elements may be, and sometimes are, disregarded to the point of asphyxiation, but they are here mentioned only as they influence development and growth. It seems certain that trout raised in a high temperature grow more rapidly than those living in colder waters, and it is more than probable that where the current is very swift too much aliment is demanded in the work of living. It is true that in the natural home of the trout many fine fish are caught in the swiftest waters. Because primarily they are fine fish they are able to stand the exertion and strain of living in this swift water; and so, being in position to catch and enjoy the abundance of natural food which the current washes down from the sources of the stream, they become the finer. Again I would warn the reader not to confound domesticated trout in pools with wild trout in mountain streams. Mr. Livingston Stone lays stress on cold, sunless water and close confinement as dwarfing influences on trout, and urges the desirability of an abundance of warm water, range, and plenty of space in growing large trout.

The following notes on the feeding of other species of fish at Neosho may be of interest:

Black Bass.—The black bass (*Micropterus salmoides*) decline a vegetable diet in any form, and can not be made to eat it. When mush is sometimes mixed with a considerable quantity of liver they will take it in the mouth, but quickly spit it out. The same results have attended frequent trials with crackers, bakers' bread, and dog biscuit. They seem averse to vegetable diet, no matter how well disguised with a mixture of meat. I have been unable to induce them to take artificial food except liver, and it must be fresh and sweet. Of course, minnows or other fish have not been tried, the effort being to overcome their natural inclination to eat fish. When the liver, as it will occasionally in summer, becomes the least bit tainted the bass refuse it. Sometimes they decline everything. This peculiarity of the bass is well known to anglers.* In the Neosho ponds the bass rarely eat on nasty, raw days, but on pretty, clear days they follow one around the pond, seeming to beg for food. The food of the young bass was discussed in my paper, The Propagation of the Black Bass in Ponds.†

The Rock Bass (*Ambloplites rupestris*).—In the first efforts at Neosho to feed these fish a small quantity of liver was daily put in their pond, but it is doubtful if they ever swallowed any of it. Sometimes they would pugnaciously dart out and take a small piece in the mouth, to immediately spit it out. Formerly every few days a small quantity of liver was put in their pond to assist in breeding the insect life which furnishes the largest and most acceptable part of their food. For two years past no artificial food has been expended on the rock bass. Their pond, of only 9,000 square feet water surface, is well planted with *Potamogeton* and *Elodea*, on which the smaller crustacea breed in such quantities as to support from 10,000 to 12,000 rock

* Book of the Black Bass, James A. Henshall, p. 360. † U. S. F. C. Bulletin, 1893, pp. 229-236.

bass each year without the introduction of any other food. Apart from any consideration of the value of these fish, they are the cheapest boarders at the hatchery.

The Channel Catfish eat the mush greedily. During the fall, winter, and early spring they were dormant, and did not come for their food. Such as was offered them during this period sank to the bottom and remained unnoticed. At other times of the year they rose to the surface and ate the mush ravenously, reminding one of pigs. They are, as is well known among anglers, very fond of liver, it being a favorite bait for them among the negro fishermen of the South. Very rarely we mixed a small amount of liver with their mush*.

The Carp and its Allies.—The food for these fishes has received such excellent treatment at the hands of Mr. Carl Nicklas that the reader is referred to the translation of his Pond Culture, to be found in the Report of the U. S. Commissioner of Fish and Fisheries for 1884. But I would state that in ponds not overstocked I have never found it necessary to employ any animal diet for this class of fishes, though it is not to be doubted that the lines of feeding laid down by Mr. Nicklas will produce the most satisfactory results in securing the best marketable weight in the shortest time.

NATURAL FOOD.

The artificial propagation of natural food for fishes reared artificially has received the serious consideration of European fish-culturists, and several of them claim to have reached the solution of the problem and to be now rearing natural food in any desired quantities at a not extravagant cost. Foremost among these was M. Lugrin, of France, a description of whose secret process may be found in the frequently quoted article published in the Bulletin of the U. S. Fish Commission for 1887. The hope was held out last year, in the meeting of the American Fisheries Society, that the French Government contemplated purchasing the secret of M. Lugrin and throwing it open to the public use.

Mr. Thomas Andrews, of England, also has for some time past been engaged in rearing natural food, but, from my understanding of his letters, his process seems to consist in allowing the natural food, principally *Gammarus* and *Limnæa*, to multiply naturally in reserve ponds and transfer the surplus to the ponds containing fish.

The method of Mr. C. G. Atkins, of the U. S. Fish Commission, can scarcely be called, in the strict sense of the term, artificial propagation of natural food.† I take it that maggots are in no sense natural food for Salmonidæ, and I think that the method, because of its extreme malodorousness, will never be acceptable to the attendant or the community in which the work is conducted.

Señor Cházari, of Mexico, uses natural food in considerable quantities, which, by reason of peculiar environments and cheap labor, he is able to collect at the low cost of 2½ and 3 cents per pound. I understand that he neither breeds the insects after the style of M. Lugrin nor uses reserve ponds after that of Mr. Andrews, but relies on neighboring swamps as a base of supply. The local technical name of the Mexican food is "mosquitte," and in answer to my inquiries Señor Cházari wrote as follows:

It is a kind of aquatic insect, being produced in large quantities in our lakes pertaining to this district, especially in that of Fercoco, and from which considerable quantities are collected every year, mixed with larvæ and other aquatic insects. It is utilized extensively as a food for singing birds. It is a species of *Coriza*, the *Coriza femorata*. It is very rich in "azoid" principles (as are almost all insects), and even more than others, and therefore is considered an excellent food for fish. I have preferred it,

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* U. S. Fish Commission Bulletin, 1883, p. 419; 1884, p. 321; and 1886, p. 137.
† Bulletin of the U. S. Fish Commission, 1893, pp. 221 et seq.

in view of these highly estimable qualities, and because it can be given to trout without any mechanical preparation, even to the smallest. Some 20,000 or 30,000 pounds a year are collected. * * * Its only defect is that it keeps but for a short time. It rots, and is devoured rapidly by other insects developed in it.

In the same letter it is stated that rainbow trout at 1 year old, fed on *Coriza*, attain a weight of 160 pounds per 1,000 fish. I know of no other place where attention is given to the *Coriza* except the Neosho Station, where it is not used for the trout but for the pond fishes, black bass, rock bass, etc.

Last year Mr. A. N. Cheney called attention to the methods of the Austrian, Carl Elder von Scheidlin, who says: * "I, by following further on the lines of the Frenchman, Lugrin, have solved" the question of proper food, "and have tested the solution as good, cheap, and practically feasible." Mr. von Scheidlin has proposed, through Mr. Cheney, to make over his method of rearing natural food for use in the United States, and correspondence is now going on to that end.

Up to the present time the only tangible effort of a European in the direction of cultivating natural food for fishes which the American fish-culturist can take hold of has not been accomplished by a fish-culturist, but is the result of investigations and experiments conducted by Dr. W. Kochs, of the University of Bonn, on the Artificial Propagation of Minute Crustaceans. The results of this work appeared in Biologisches Centralblatt, October, 1892, and on account of its exceeding value a full translation is offered on pp. 306–308 of this paper. Occasion is taken to recommend for consideration, particularly of the pond culturist, the suggestion of Dr. Kochs to construct insect-breeding ditches along the banks of the ponds, from which the infusoria and crustacea may find their way into the ponds. Observation has fully convinced me of the value of the hint given by Dr. Kochs of the fondness exhibited by *Gammarus* for dry brushwood, and I might state that the same seems true of all woods in which decay has commenced; *Coriza* in particular seems to frequent half-rotted logs lying in warm, shallow water, though I believe *Gammarus* prefers clean running streams. I have found it most abundant in water of a temperature not unpleasant for drinking.

Translations of portions of reports by M. Chabot-Karlen on the fish-cultural operations of MM. Durand, Binder, Després, and other culturists of France are submitted on pp. 309–311. I would invite attention particularly to M. Durand's method of propagating the *Cyclops*, and I am prepared, from my own observations, to unqualifiedly indorse his remarks as to the value of *Potamogeton* and *Nasturtium* as a shelter for the smaller crustacea.

As before intimated, little or no systematic attention, except on an experimental scale, has been given this subject by American fish-culturists; the only approach to the European method of which I am aware being that at the private ponds of Mr. Fairbank, of Illinois, and even there the effort is like that of Mr. Andrews.

One of the objections which has been raised to the employment of natural food is the time and expense which would be involved in collecting enough for feeding a large number of fish. To this I make answer: First, be certain how much food you need to produce the best results. A comparison of the values of different foods as determined by chemical analysis and as exhibited on page 295 will show that from 7 to 10 pounds of the artificial food may well be replaced by 1 pound of natural food. I say well replaced, because if 1 pound will do the work why burden the system with the useless 9 pounds ?

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* U. S. Fish Commission Bulletin, 1893, p. 278.

EXPERIMENTS WITH ARTIFICIAL PROPAGATION OF MINUTE CRUSTACEANS.*

By Dr. W. Kochs, *University of Bonn.*

Within the last twenty years fish-culturists have become more and more convinced that the knowledge and dissemination of minute crustaceans and other lower animals inhabiting fresh water are of the greatest benefit to fishing. The growth of the young brood and the faculty of the full-grown fish to increase under favorable conditions are in the first instance regulated by the facility of obtaining good food, and this regularly and abundantly. Emil Weeger delivered an interesting lecture on this subject at the International Agricultural and Forestry Congress at Vienna in 1890, which was later published with illustrations showing "strongly magnified representations of several species of crustaceans frequently found in the waters of central Europe and insects belonging to the family of gnats, May flies, and dayflies, all serving as food for fishes."

At the close of this lecture Victor Burda, fish-culturist of Bielitz, spoke on the same subject and added, relative to the propagation of fish in large ponds, that these small infusoria were not only of the greatest importance for salmon-breeding, as stated by Weeger, but also for carp-breeding; it was a subject which would demand the greatest attention among experts, because it was known ever since the well-known expert, Director Lusta, had lifted the veil behind which the question of the nutrition of the carp had been screened for so long a time, that the principal food of the carps, like that of the salmon, not only in its earliest stage, but also later, consists of animal life, and he asks why the artificial breeding methods of the water fauna, as suggested by Weeger, should not be adopted.

Mr. Burda then continues and points out some measures by which the propagator might exert a beneficial influence upon the growth of this minute water fauna. Starting from the idea, and this idea is correct, that the minute crustaceans live on infusoria, and that these infusoria again thrive on plants in the process of decomposition and on animal life, he endeavors to supply the ponds with the necessary and appropriate food. He says:

"The decomposed substance serving as food for the infusoria accumulates on the bottom of the pond, and is also mechanically distributed in the water, giving it a muddy appearance. The substance distributed in the water partly originates on the bottom, partly enters the pond with the new influx, in which case it comes from the soil, near by or far off, according to the condition of land or water. The more luxuriant and the more fertile the land the richer the ingredients washed into the pond. It is, therefore, of the greatest importance to have the greatest amount of this muddy influx led into the pond after a heavy rainfall."

This is doubtless correct, but it is also a fact that this acquisition to the pond is gained at the expense of the surrounding lands, because they are impoverished by the heavy rainfalls. Of course considerable values in the shape of organic and inorganic substances wash from the fields into the brook, from there flow into the rivers, and then into the ocean, and so would become lost if they were not collected in the ponds and subsequently absorbed by the fishes. But a correct pond propagation must not depend on circumstances; just as a certain quantity and quality of manure must each year be supplied to the field to produce fair crops, so the same action must be taken in regard to the fish ponds. Dr. Kochs tried for a year to catch the crustaceans described on Weeger's plates and to breed them in glass vessels holding from 8 to 10 liters (1 liter is equal to 2.113 pints) for the purpose of investigating their conditions of life. He found them only in puddles, which received their fertilizing substance from the surrounding land or from animal cadavers. In one case, in a puddle in a clay pit near Winterschlick, he found that dung particles had been washed into the puddle from an adjoining sloping orchard, where numerous dung heaps were found. The consequence was a luxurious vegetation and numerous crustaceans in this puddle, while in many other adjacent puddles hardly anything living could be detected.

It is not essential to catch a great number, because they increase wonderfully. To obtain those species in a perfect condition, which collect between the water plants, he used a pear-shaped pipette holding 1 liter, having a long and strong, but narrow, neck, and on the other end, in the pear, an aperture 1 centimeter wide. When, closing the narrow neck and placing the pear end of the vessel in the water, the stopper is suddenly removed, the water will rush into the vessel, carrying with it the small infusoria. It is not possible to catch nearly as many with mull netting, besides the latter is unserviceable between the water plants, and it is difficult to separate the infusoria from it.

Dr. Kochs has prepared since June, 1891, a number of glass vessels as aquaria, in each of which he placed all kinds of crustaceans. Some he kept at his private residence in the open air and during the

* Translated by H. H. Gerdes from Biologisches Centralblatt, Band XII, pp. 599–606.

winter in a warm room; others he kept in the Pharmacological Institute in a room not heated, but not exposed to frost; others, again, since January, at the Physiological Laboratory for Animals at the Academy of Toppelsdorf, near Bonn, in a room exposed to all atmospheric changes. One set of the aquaria was prepared as called for by Weeger; that is, 10 cubic centimeters of garden soil were placed on the bottom and soaked with liquid manure; on this was placed mud from the puddles containing crustaceans, and on this, again, dry leaves of hazelnut and willow trees. The aquarium was then filled up with water. Some filiform algæ, *Wolffia*, and other small water plants had entered into the aquarium with the mud. In the course of two weeks there developed in all the aquaria minute crustaceans (shell insects, flea lobsters, water multipedes, infusoria, green algæ), a felted mass of filiform algæ, and a thick cover of *Wolffia*. The warmer the aquarium the quicker and better was the development, but the plant life seemed to prosper better than the animal life. By catching these small crustaceans in proper pipettes it was shown that the quantity in the aquarium was less than in running water.

Subsequent experiments proved that the majority of the crustacea were very easily affected by even the smallest quantity of ammonia, sulphureted hydrogen, or free acids, as also stated by Weeger. It is clear that only the most favorable conditions for the development of the crustacea in the aquaria prepared according to Weeger are mentioned. Then comes a period, which passes quickly, developing a good deal of this animal life. Dr. Kochs tried to accelerate the increase by throwing in small pieces of meat or dung, sometimes with more or less success, and to raise larger individuals, having the most success with the water multipedes.

These experiments soon convinced him that water in which the crustacea grow well and increase was too unclean for most fishes; moreover, the crustacea require warm and more or less stagnant water, and can, therefore, only be raised in shallow puddles exposed to the sun and containing many water plants, whereby it is clearly shown that the propagation of infusoria for fish food must be entirely separated from the breeding of fishes. When attempting to breed both in the same vessel, either the water fauna prosper and in that case the fishes can not live, or vice versa. He ascertained, also, through special experiments, that the minute crustacea could hardly live in water most favorable for the growth of microscopic plant life.

Mixing 0.1 liter of nitrate of ammonia, 0.1 liter of biphosphate of potash, and a minute quantity of iron with the strongly calciferous water from the city hydrant in Bonn, and adding a small number of water plants, the water will soon turn strongly green and turbid at a temperature of from 10° to 12° C. (50° to 54° F.), and becomes slimy on account of the algæ. *Daphnia* and *Cypris* will hardly grow therein.

His aim to first produce, in the proper manner, large quantities of greenish water rich in plant life for the sustenance of the crustacea proved a failure. Still it is true that many crustacea live on microscopic plants, but the most favorable condition of life does not tally with that of the plants.

The crustacea are only good in transparent and clear water; all the fine aquaria tested for years contained large water plants, but also always clear water.

Later he experimented as follows:

To make the method to breed crustacea artificially practicable and feasible the material needed must be easily accessible and cheap. If the breeding is done in special receptacles (reservoirs) it must be done in such a way that it will be easy to get the infusoria clean when fed to the fishes. The following experiment led him to a procedure which in his opinion will prove successful: Taking two glass vessels each containing 10 liters of water (21.13 pints) and adding 100 grams (3.53 ounces avoirdupois) of fresh cow manure without straw in such a way that in one vessel this manure is evenly distributed, while in the other these 100 grams of manure are placed in a glass cup and covered by wire netting, it will soon be observed, especially where the temperature is warm, that a strong decomposition takes place in the first-mentioned vessel, a thick scum of bacteria is formed, the liquid turns light-brown and smells strongly of musk and ammonia. *Cypris* and *Daphnia* may live, and even increase, in this bad-smelling liquid, if the temperature is not too high, and under the described conditions. On the other hand, there is hardly any smell in the second vessel, where the manure is inclosed in the cup. The gases forming in the manure raise the cup, bottom upward, to the surface of the water, which is soon covered with a scum consisting of numerous bacteria and infusoria. The outer side of the wall of this cup, and also the bottom of the large vessel, is soon covered with a white slime, also consisting of bacteria and infusoria. After some time only organisms are developed containing chlorophyl (green coloring matter of leaves or plants) in large quantities. *Daphnia*, *Cypris*, *Cyclops*, and many other crustacea grow finely in such a vessel. The wire netting which prevents the cow manure from mixing with the water is thickly covered with minute crustacea searching for food. As the water

remains nearly clear, it is somewhat easy to catch the animals, and one may so become convinced of the phenomenal increase.

Under the influence of water and warmth a vast development takes place of those numerous microorganisms contained in the cow manure which absorb the undigested parts of the manure, and which serve themselves as food for the crustacea. The manure gradually disappeared during the months of May, June, and July. When these crustacea are fed to small carp or goldfishes a gradual transformation of cow dung into fish is accomplished, almost without the help of plants.

The *Gammarus pulex* has lately frequently been found in large quantities between old bricks and half-rotten brush wood in the Endenich Brook, near Bonn, without any cells containing chlorophyl having been found in the water or mud. The water of the brook was muddy, because it contained the waste and drainage of several adjoining villages. This relatively large crustacean grows splendidly in an aquarium prepared with cow dung, as previously described, if a little dry brush wood is added.

Practically, it will be easy to produce this transformation of cow dung into fish, subject to local conditions. The most advantageous way would seem to be to dig ditches along the banks of the pond about 1 meter wide and 25 centimeters deep (about 40 inches by 10 inches) connected with the pond by numerous narrow cuts. Perforated boxes or flower pots filled with cow dung are then placed in these ditches and protected from the rays of the sun. When this shallow water is warmed by the sun a great quantity of infusoria and crustacea will develop, which by the rise and fall of the water in the pond are sucked into it. If the banks of the pond are low, the fertilizing substance will settle there, thus enlarging the area for the breeding of the crustacea and forming a feeding-place for the young fishes.

All these infusoria are especially sensitive to light. The ditches and banks must have old bricks, brushwood, leaves, etc., for the protection of animal life. A luxuriant growth of water plants, especially *Wolffia*, must be prevented, because it absorbs too much nourishment from the water; that is, the nourishment is collected in the plant in such a shape that it is unserviceable for the purposes of fish propagation.*

These breeding ditches must, if possible, be dry in winter, so that the frost may easily penetrate. In that case the winter eggs of the crustacea, bedded in the mire, will develop better and more numerously in the spring than when having overwintered in water. It would be very interesting, but very difficult, to determine the causes of this peculiar process. Dr. Kochs exposed the mud of several aquaria in an open box to the sun, to rain, and to frost by keeping it in the gutter of the roof of his residence. By putting samples in glass vessels filled with boiled hydrant water and placing them in a warm room, there developed within three weeks *Cypris*, *Daphnia*, and microscopic wheel animalculæ, especially *Hydatina senta* and infusoria. It is certain that the eggs had several times been exposed to -10° C. (14° F.). At the end of May several samples of the same, now air-dried mud, were put into water previously boiled, and in two weeks numerous crustacea had again developed. By drying a large quantity of egg-containing mud in the fall, the proper food may easily be bred in the spring and summer.

It must here be stated that the eggs will not stand a drying over sulphuric or anhydric phosphoric acid. When that is done they all die, as has often been observed. This is mentioned because it is frequently asserted that the eggs of the lower animals may live for one or more years in the thoroughly dried mud puddles. Even mud, cleft and disrupted by the action of the sun, still contains several parts of water. A total drying up of the eggs, therefore, does not take place in nature.

Dr. Kochs made special experiments with the *Helix pomatia*, and found that under the usual conditions the moisture of the living animal does not dry up in a year, even in a warm room; moreover, as soon as a dry crust has been formed around it, it loses the moisture only in artificially dried air, but it dies before all the moisture is absorbed. The poisonous substances forming at the bottom of the ponds by a slow decomposition of organic substances at such times of the year when there is no frost are destroyed by the plant life. These infusoria, and also the eggs of the lower animals, are frequently threatened by an accumulation of those poisonous substances during such times in winter when this process does not take place. Half-decomposed organic substances are loosened and made spongy by the frost, and later on easily crumble or dissolve. Only the drying and freezing of the mud, therefore, can be recommended.

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* I think it pertinent at this point to remark that Dr. Kochs's warning against allowing a luxuriant growth of water plants in the ponds has reference to his method of "transforming cow dung into fish without the help of plants." Ordinarily—that is to say, naturally—the *vis* or fertilizing strength of the manure would go to making a luxuriant growth of plant life, which in turn would be converted into the low forms of animal life exhibited in the infusoria and crustacea.

REPORT BY M. CHABOT-KARLEN ON THE FISH-CULTURAL OPERATIONS OF M. DURAND, AT THE SCHOOL OF AGRICULTURE AT BEAUNE.*

The author states that fish-cultural operations were commenced at the School of Agriculture and Viticulture of Beaune in 1886-87, near the Bouzaize, one of the affluents of the Saône; that there were at the time no trout in the vicinity or in the neighboring rivers, and that it was necessary to buy eggs. The first year 12,000 fry were obtained, which were divided into three lots. Two lots of 3,000 each were planted in the Ouche and Muzin; the rest were liberated in the Bouzaize or held in confinement near the shore and fed on *Cyclops* and afterwards on *Gammarus*. The second year 17,000 fry were obtained; the two rivers above named received 6,000, the Vouge but 1,000; 500 were planted in the Love, and the rest put into the Bouzaize, a part at liberty and a part in confinement. At the present time 18,000 fry are ready to be distributed. In three seasons 47,000 fry have been turned out.

In the Ouche, in which the trout were previously unknown, it is now possible to take them weighing 400 grams (about 14 ounces), those that were put in first being 23 months old. M. Brossard, director of bridges and roads at Bligny-sur-Ouche, says that numbers of them of this weight can be seen in the upper parts of the stream. As to those 1 year old, they have attained a weight of 100 grams (about 3½ ounces). Moreover, natural reproduction will commence next season, and the conditions in this river are so favorable that its stocking by this method is assured, as the fish will be in condition to spawn in December, 1889. In the Muzin the same results would have been obtained had it not been for poaching. Nevertheless, in spite of this and of the devices of every kind that were employed by the mills along the stream, the trout reappeared in the Muzin.

More or less similar results were obtained in the Bouzaize. Reared in captivity in receptacles abundantly provided with aquatic plants, *Potamogeton* and cress, and fed with *Cyclops* and aquatic larvæ of every kind at first, and then with *Gammarus*, the trout gained in a year an average of 60½ grams (about 2 ounces). At this age they were not able to cope with the large pike that infested the mill course at the head of the river; this was emptied and the larger ones taken out, only those of the size of the young trout being permitted to remain. Now, at the age of 23 months, a great number of the trout weigh more than 300 grams (about 10½ ounces). The following are the weights of some taken in the river: First, 365 grams; second, 360 grams; third, 280 grams; average weight, 335 grams (about 11½ ounces). So that in a year their weight increased from 60½ to 335 grams, a gain of 274½ grams in twelve months. Natural reproduction may be expected to commence in this river from December, 1889.

The report also contains observations on the *Cyclops* (which are presented with a view to furnishing the basis of a method for the rearing of these), the *Daphnia*, and the *Cypris*, with some remarks on the monstrosities found with the eggs of the trout and a statement of prices obtained for trout.

The *Cyclops* possesses an extraordinary fecundity, and reproduces at a temperature of from 8° to 10° C. (46° to 50° F. about). In winter they seek the bottom and hibernate in some sort, but on capturing them and placing them in a higher temperature their generative organs will be seen to revive. Thirty-five degrees C. (95° F.), however, according to our experience, is the highest they can resist. The best for hatching is between 20° and 25° C. (68° and 77° F.). At this temperature there forms on each female every two days two egg-bearing sacs, or external uteri, wherein the eggs are hatched. At the end of two days these organs become detached and fall to the bottom. The number of eggs contained in each may be from 16 to 32, but generally the number of young obtained is somewhat less. However, the eggs hatch immediately, and the young *Cyclops* which issue forth are almost globular, having but four feet and no tail. At the end of fifteen days they undergo a molting, the tail appears and other feet form, and fifteen days after—that is, a month in all, the *Cyclops* are mature and ready to reproduce.

With such fecundity, it can be readily understood how numerous they become. Carbonate of lime is necessary in the formation of their shell. From the fact that they are found in abundance in water infused with vegetable matter in decomposition, the water, nevertheless, not contracting the least odor, it is supposed that they live on infusoria, and that, therefore, the means by which the fish-culturist may have them at his disposal is to multiply in his rearing ponds aquatic plants. (*Potamo-*

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* The report was published by the National Society of Agriculture of France, June 19, 1889. The papers in this Appendix were translated by Mr. F. P. Fennell, of the U. S. Fish Commission; none of them have been translated in full, only such portions being presented as apply to the feeding and rate of growth of the fishes.

geton crispus gives the best results.) In this way the *Cyclops* will live and reproduce with the young fish. By digging in a neighboring field one or more holes into which is introduced a small stream of water and placing therein the *Potamogetons* and fountain cress (*Nasturtium officinalis?*) (this last agrees with the *Gammarus*) a temperature will be obtained at which the *Cyclops* can propagate in great numbers; and there will be at hand in abundance the best food that can be given to the young fish. The fish-culturist who possesses clayey land can undertake this without expense. In basins so prepared it will not be long before confervæ and vaucherias will be seen to form, which, after a while, becoming decomposed, will take on a brown tint, and in the midst of which the little creatures will be very abundant.

For collecting the *Cyclops* a simple net is used, similar to that employed by entomologists. This lets the water pass and retains a multitude of animalcules, not only *Cyclops*, but the larvæ of gnats, *Hydrachnas*, etc., of which the fry are very fond.

The rearing of *Daphnia pulex* and *Cypris fusca* was also tried. The *Cypris*, however, were found to prey upon the young fish. Having been put in with the embryos of the carp, they were often discovered to the number of two or three fixed upon the back of an alevin devouring it, notwithstanding the efforts of the poor animal to shake itself free. It was, therefore, necessary to abandon their use, and with regret, because their fecundity is certainly much greater than that of the *Cyclops*, and they mature much more quickly. It is believed that this fact is absolutely new in the history of applied fish-culture.

Finally, attention is called to the great number of monstrosities found among eggs taken from the trout at Vougeot, at the establishment of M. Peloux. These breeders were reared by M. Peloux and came from the same parents, and it is asked whether these deformities may not be attributed to consanguinity.

REPORT BY M. CHABOT-KARLEN ON THE FISH-CULTURAL OPERATIONS OF M. BINDER, PROFESSOR AT THE SCHOOL OF AGRICULTURE OF SAINT-RÉMY (HAUTE-SAÔNE).*

In this paper it is stated that during the three years that fish-cultural operations were conducted at this school 100,000 trout were planted in the Lanterne and Moselotte; and that such good results were obtained in the Lanterne that the young fish could be seen therein as numerous as minnows; that those 14 months old weighed 8 to 16 grams (0.28 ounce to 0.56 ounce) with a length of 7 to 12 centimeters (2.75 inches to 4.72 inches).

REPORT BY M. CHABOT-KARLEN ON THE NOTES OF M. DESPRÉS, PROPRIETOR OF THE FISH-CULTURAL ESTABLISHMENT OF NANTEUIL-EN-VALLÉE (CHARENTE).†

This paper has reference to the notes of M. Després on rearing salmonidæ by artificial food. He says that the development of the embryo especially attracted his attention; that it was between the third and fourth day before the absorption of the sac that the alevin would become hungry and commence to eat, not seeking its food, but lying in wait for it; that six or seven days after it would quit its hiding-place and attack its prey, snapping at it while in movement in the water. He then enters into a description of the means to be employed for the protection and feeding of the young, and he seems to have succeeded in his experiments if, as he says, he is able to guarantee the rearing of 90 per cent. At Howietoun it is on the weight (one-fiftieth of the living weight) that is determined the food to be given, a method which appears more scientific and at the same time more practical than that of feeding them without regard to age or development. The choice of food largely depends upon environment. At Howietoun mollusks are used to a great extent, while at Nanteuil brains, blood, and *Limax* satisfactorily replace these shore animals, of which the alevins are very fond.

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† Presented to the National Society of Agriculture of France, June 30, 1886.

REPORT BY M. CHABOT-KARLEN ON THE VIEWS OF M. ÉMILE RIVOIRON ON THE REARING OF TROUT BY NATURAL FOOD.*

M. Rivoiron says that the young trout do not take food except when it is moving in the water; that they do not go to the bottom. Unless great care is taken, which is not always possible, failure is certain in the use of artificial food on account of decomposition. Of the natural food M. Rivoiron prefers the *Daphnias.* To rear these he says: Dig near the side of the stream two, four, or six basins, from 10 to 12 meters (about 32 feet and 9 inches to 39 feet and 5 inches) long, by 2 meters ($6\frac{1}{2}$ feet) wide, and $1\frac{1}{2}$ meters (about 5 feet) deep, according to the number of *Daphnias* to be produced. Clayey soil is preferable, as the water with which the basins are filled will not quickly evaporate. In these there should be placed during March, at the north end, because the basins should be dug as near as possible from north to south, one cubic meter (about $1\frac{1}{3}$ cubic yards) of fresh dung (cow dung and horse dung mixed).

Every day the water should be stirred until it takes on a light-brown color, without, however, becoming tainted. On this point depends somewhat the success of the microscopic beings that during the first days of April should be deposited there. At a temperature of 25° C. (77° F.) each of these will give birth every five days to eight others, which in a few weeks will amount to millions. They reproduce even at a temperature of 32° C. (about 90° F.), and sustain a temperature of —6° C. (about 21° F.). The least shock will kill them en masse. Under no circumstances should the water be disturbed, and they should be gathered with the utmost care. This gathering (a sort of skimming) can be commenced at the end of April and continued until the end of September. It can be done by means of a strainer, which should be brought gently to the surface. Before being given to the alevins the *Daphnias* should be placed in fresh water, in order to rid them of the odor with which they may be impregnated; otherwise they will kill the young fish. It is supposed that the ammonia in the rearing basin is the cause. A basin should never be fished to the bottom, and eight or ten days should elapse, according as the temperature will have more or less favored the multiplication of the crustacea, before recommencing the operation. When giving them to the alevins the same precautions should be taken with the *Daphnias* as when collecting them, and it is essential that they should be deposited in the water very slowly. A basin of the above dimensions will cost 35 francs, and will furnish, from April to September, from 170 to 180 kilograms (374 to 396 pounds, avoirdupois) of *Daphnias.* An alevin so fed will weigh at six months 6 grams (0.21 ounce), with a length of 6 centimeters (about $2\frac{3}{8}$ inches).

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* Made to the National Society of Agriculture of France, July 1, 1885.

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20.—A REPORT UPON INVESTIGATIONS IN THE MAUMEE RIVER BASIN DURING THE SUMMER OF 1893.

By PHILIP H. KIRSCH,
Commissioner of Fisheries for the State of Indiana.

The investigations upon which this report is based were made during the summer of 1893, under the direction of Hon. Marshall McDonald, United States Commissioner of Fish and Fisheries. A description of each stream and lake examined is given, with a list of the fishes found in these waters and notes on their characteristics. In prosecuting the work the writer had the efficient help of Mr. Charles Beeson, instructor in Indiana University; Prof. W. S. Blatchley, teacher of biology in the Terre Haute High School, and, for a short time, Mr. Jesse Harrison, of Columbia City, Ind.

In the summer of 1887 Prof. Seth E. Meek, professor of zoology in Arkansas Agricultural College, made a small collection of fishes in Defiance County, Ohio. The writer is indebted to him for the use of his unpublished notes.

For aid received in various ways the writer is under special obligations to Prof. Barton W. Evermann, assistant to the United States Fish Commission.

THE MAUMEE RIVER SYSTEM.

The Maumee River, with its tributaries, drains a tract of country lying in the northeastern part of Ohio, including parts of the counties of Hillsdale and Lenawee, on the southern border of Michigan, and portions of Steuben, Dekalb, Allen, and Adams counties, in the northeastern part of Indiana. In all, this water basin embraces about 7,500 square miles. The country is rolling, but contains no elevations worth noting. The surface is everywhere composed of glacial drift, but bed rock is exposed in the channel of the Maumee River and in the lower courses of all its larger tributaries.

The climate in this region is generally mild and considered healthful. According to the report of the Ohio meteorological bureau, the normal temperature at Toledo, Ohio, for a period of twenty-two years was 50° F. The highest temperature at the same place during a period of seven years was 94°, and the lowest during the same period was —7°. The average annual amount of precipitation (including melted snow) at Toledo for a period of twenty-two years was 32.03 inches.

The water in the Maumee River and that of its larger tributaries is rather clear, while that in the smaller streams, on account of their clay channels, is more or less turbid. The water of all the lakes examined by us is remarkably clear and pure.

Besides a great abundance of the smaller varieties of fishes, all the waters that were investigated by us were well supplied with the best quality of native game and food fishes. Crawfish and mussels were found rather common at all points explored by us in the Maumee Basin. Fresh-water shrimps were also taken in several of the streams. In some localities water snails were found in great numbers. At other places the banks of the streams contained numerous snail shells. Batrachians and

reptiles were found common throughout the Maumee River basin, and specimens were noted and secured at nearly all points investigated by us.

The following is a classified list of the waters examined:

Maumee River:
- St. Joseph River
  - Fish Lake.
  - Fish Creek.
  - Big Run.
  - Indian Lake.
  - Cedar Lake.
  - Cedar Creek.
  - Mill Creek.
- St. Marys River.
- Gordon Creek.

Maumee River—Continued.
- Lost Creek (near Cecil, Ohio).
- Tiffin River.
  - Devils Lake.
  - Manitou Beach
- Auglaize River.
  - Sugar Creek.
  - Lost Creek (near Lima, Ohio).
  - Blanchard River.
  - Hoaglin Creek.
- Beaver Creek.

THE MAUMEE RIVER.

The Maumee River is formed at the city of Fort Wayne, Ind., by the confluence of the St. Joseph and St. Marys rivers. It flows in a general northeast direction for a distance of 96 miles through Paulding, Defiance, Henry, and Lucas counties, Ohio, and near its mouth it forms the northwest boundary of Wood County, Ohio. At Toledo it empties into Lake Erie through Maumee Bay.

According to the Indiana Geological Report, 1878, the Maumee River at Fort Wayne has an elevation above sea level of 737 feet, and at its mouth of 573 feet. The river has therefore a fall, in its total length of 96 miles, of 164 feet, or $1\frac{2}{3}$ feet per mile.

The Maumee River was examined at the following places:

(*a*) Fort Wayne, Ind., August 14 and 15: The channel at this place has been straightened and the old water-course has been filled up with gravel and rubbish that were washed in by overflows of the river. The bottom is of solid Devonian limestone. The banks of the channel are about 15 feet high, and are composed of whitish clay. The water is mostly deep, with but few shoals. Immediately below the city, where the measurements of the river were taken, the stream is confined in a rocky channel 33 feet wide, and has an average depth of 3 feet and a current of 1.86 feet per second. Therefore the volume of water conveyed per minute was 82,863 gallons. The temperature at the bottom of this current of water was 76°.

The St. Marys River for some distance up from its mouth has been straightened and the stream is now confined to a ditch-like channel which is about 40 feet wide. The channel of the St. Joseph River has a width of about 50 feet. The St. Joseph River conveys somewhat the larger quantity of water.

(*b*) The Maumee River was fished August 16, about $2\frac{1}{2}$ miles above Antwerp, Ohio. The channel has a width of about 250 feet, and the banks on the sides of the bottom lands are about 10 feet high. The bottom of the channel is of Devonian limestone, with numerous loose rocks scattered over it. There are long stretches of deep water, which are connected by short rocky riffles. Low islands in the river and low sloping banks are entirely covered with water willow. There are also dense growths of wrackweed. In water only a few inches deep the rocks as well as the earth bottom is covered with algæ, mostly *Spirogyra*. Willows and horseweed form dense thickets along the margins of the stream.

(*c*) The Maumee River, near Cecil, Ohio: Prof. Seth E. Meek says that the current at this place is swifter than usual and that the bottom of the river is sandy, or in a few places rocky.

(*d*) The Maumee River was investigated at the State dam, 4 miles below Defiance, Ohio, August 19. Here the river has a width of 600 feet; its bottom is of shale (Devonian) and free from loose rocks. The riffles below the dam extend down the river for half a mile; they are well grown over with riverweed, wrackweed, and other water plants. There is an abundance of algæ. The banks of the channel are from 10 to 15 feet high. The surrounding country is decidedly rolling. The dam has a width of 600 feet and is 7 feet high. It is provided with a fishway. Below the dam is good fishing with hook and line. Black bass, rock bass, calico bass, and redhorse are the commonest of food-fishes taken. This dam was built by the State of Ohio for a feeder to the Miami and Erie Canal. The termini of this canal are at Cincinnati and Toledo, Ohio. At Defiance the canal enters the Maumee River on the south side and after crossing to the north side it follows in the channel of the river down to the State dam. Here the canal quits the dam on its north side. This canal is still in use, chiefly for rafting logs from the river to manufacturing establishments.

(*e*) At Grand Rapids, Ohio, the Maumee River was examined August 21 and 22. The work was done on the rapids below the Providence dam, which is half a mile above the town of Grand Rapids. The bottom of the channel is of a fine-grained sandstone (Devonian), which is being largely quarried for building purposes. The surface of the rocks is eroded into long, deep ruts and numerous pot-holes. Where the rocks have been quarried are deep pools of water, which contain large quantities of fish. At our investigation the river was low with no water on the riffles, except what little escaped through a leak in the dam. The canal on the north side of the rapids and the mill-race on the south side convey a small quantity of water.

This dam, like the one near Defiance, was built by the State of Ohio for a feeder to the Miami and Erie Canal. The dam is constructed on either side of an island, which is known as Purdy Island. That part of the dam on the south side of the island is 660 feet wide, and the part of the dam on the north of the island has a width of 1,205 feet. The island between the two dams has a width of 350 feet and contains 8 acres. The dam has a nearly uniform height of 5 feet and is provided with a fishway in good condition. It is said here that the dam backs up the water for 14 miles. The width of the river at the wagon bridge below town is 653 feet. This is probably the average width of the river at this place.

(*f*) The Maumee River at Waterville, Lucas County, Ohio, was fished August 24. Here the bottom of the channel is of limestone (Upper Silurian), which lies in contorted folds and has many irregular outcrops. The small quantity of water in the channel was distributed among several irregular streams. At this place is an island containing 22 acres, which divides the river into two nearly equal channels. At the wagon bridge, 100 yards below the island, the channel is 850 feet wide.

Two miles above this place is an island which contains 240 acres, and is known as Station Island. On either side of this island the water is "slack," having a depth of about 25 feet, and is said to afford fine pickerel and bass fishing with hook and line.

The bottom of the river, on account of its hard, clean rock, is remarkably free from vegetation.

Local sportsmen told me that formerly sturgeon were very abundant at this place, while now one is seldom taken; also that the large pike (*Lucius lucius*), pickerel, and eels are rapidly decreasing in numbers. All of this decrease of fish is claimed by them to be due to the net fishing in the backwater in the river during the season when these fishes ascend the stream to spawn.

(*g*) The Maumee River was examined at Toledo, Ohio, August 25, 26, and 28. The width of this river at the wagon and street-car bridge is 1,500 feet, and the depth of the water at points across the river about 100 feet apart, beginning on the west side, was respectively 16 feet, 26 feet, 22½ feet, 21 feet, 20½ feet, 17½ feet, 12½ feet, and 12½ feet. The deepest water is under the turn bridge, where the boats pass through. At all these places the water had a bottom temperature of 75°.

ST. JOSEPH RIVER.

The St. Joseph River has its rise in the uplands of Hillsdale County, Mich. Its general course is southwest through Williams County and the southeast corner of Dekalb County, Ind., to Fort Wayne, Allen County, Ind., where it joins the St. Marys River to form the Maumee River. This river was examined at the following places:

(*a*) Near Hudson, Mich., July 24: The river was examined at a point 6 miles southwest of Hudson. Here the stream was fished for a distance of nearly 2 miles. The upper mile examined flows through woodland, and the bottom of the channel is mostly gravel, but at some places mud. There are several large drifts of wood in the stream that are barriers to the passage of fish. Further down, the stream flows through cleared land and the bottom of the channel is of bluish clay, which has eroded very unevenly, leaving many projections and numerous holes. There are many long stretches of quiet water, with in some places a depth of 4 feet. Riffles are few. The channel has an average width of about 14 feet. The bottom is remarkably clear of weeds. The most common plants at the water's edge are wild touch-me-nots, Joe-Pye weed, shrub dogwood, and prickly ash. Owing to the clayey bottom the water is not clear. Where the volume of water was taken the stream had a width of 10⅓ feet, an average depth of 14 inches, and a rate of current of 13 inches per second. This gives a volume of about 55,000 gallons per minute.

The banks of the channel are from 6 to 8 feet high.

(*b*) Edgerton, Williams County, Ohio, July 28: The St. Joseph River was seined at a point 3½ miles southeast of Edgerton. Here the river has a width of 45 to 50 feet; the almost perpendicular banks are 8 to 10 feet high. The bottom of the channel is mostly of sand and gravel with occasional loose rocks. The riffles are few, and almost entirely free from weeds. The shores are lined with common weeds, shrubbery, and trees. On account of the recent rains the water was tinged with the clay that composes a large part of the banks and bottom of the channel.

(*c*) The St. Joseph River was next examined at Fort Wayne, Ind., August 14.

FISH LAKE.

Fish Lake, at Hamilton, Steuben County, Ind., July 19 and 20: What is now known as Fish Lake was formerly in three different bodies of water. In 1837 the outlet was filled in and the surface of the lake was thus raised 9 feet, which united the three lakes into one body of water. The water power of this lake is utilized for milling purposes, and is at present controlled by the Fort Wayne Water Power Company.

Fish Lake has a length, from northwest to southeast, of about 3 miles, and its greatest width is about 1 mile. It has several islands, the largest of which contains 13 acres, the others less than 1 acre each.

The large island is covered with a growth of small oak.

That portion of the lake lying west of the large island is known as Fee Lake, that north and east of it as the Main Lake, and that south of it as the Mill Pond.

Fee Lake has a rather uniform depth of 25 to 33 feet. Temperature at bottom, 77°.

The shores of the main lake at its northwest and east sides are gravelly, with clean bottom, and the banks at either place have a height of from 10 to 12 feet, and are covered with woods. The remainder of the shores of this part of the lake are swampy, except along the large island, where the bottom is rather clean and solid. On the east side of the main lake are several strong springs. The water of these springs is charged with iron, and has a temperature of 49° F. In the lake near these springs were taken a number of *Labidesthes sicculus*, but all were of small size. Here were also found a few specimens of *Semotilus atromaculatus* and one *Pimephales notatus*. None of these species was found elsewhere in the lake. The greatest depth we were able to find is a short distance northeast of the large island, where it was 62 feet deep, and the temperature of the water at this depth was 75°. A little farther southeast of this point, near the middle of the main lake, the depth was only 30 feet and the temperature of the water 57°. The low temperature of the water at this point would indicate the presence of strong bottom springs. The upper end of the main lake has a nearly uniform depth of 50 to 60 feet and a temperature of 70° to 75°.

A bay extends from the northeast side of the main lake in a southeast direction. It has a length of three-quarters of a mile, and along its middle line a depth of 40 feet and a temperature of 67°. Toward the shores the water gets shallower, with a corresponding increase in temperature. In 12-foot water the temperature was 70°.

The bottom of the mill pond is almost entirely covered with weeds, and it is only along the middle where the weeds do not appear above the surface of the water. The depth of this portion of the lake is from 7 to 9 feet, and the temperature of the water at this depth was 73° to 74°. The temperature of the water immediately below the surface in all parts of Fish Lake was 78°.

Fully a quarter of the entire area of the bottom of Fish Lake is covered with weeds, of which the most common are chara, pondweed, and riverweed. Near the shores are water lilies in abundance. Along the water's edge are giant bulrush and large thickets of water smartweed. The prevailing trees upon the banks are oaks, maples, elm, and cottonwood.

The water in this lake is clear and well stocked with native game and food fish. The ringed perch (*Perca flavescens*), the blue gill (*Lepomis pallidus*), the common sunfish (*Lepomis gibbosus*), and the large-mouthed black bass (*Micropterus salmoides*) are among the most common fishes. We were told that illegal fishing has not been practiced at this lake, and the abundance of game-fish is the result.

Fish Lake receives its waters from several ditch-like tributaries, but chiefly from the springs along its shores and bottom. It empties its waters from the lower end of the mill pond into Fish Creek, of which it is the source.

FISH CREEK.

Fish Creek, near Hamilton, Ind., July 21: The width of Fish Creek immediately below Fish Lake is 13 feet, its average depth 7 inches, and the rate of current was $6\frac{3}{4}$ inches per second. The lake therefore discharged 2,000 gallons of water per minute.

The stream flows in a southeasterly direction and joins the St. Joseph River near Edgerton, Ohio. A few hundred yards below its source it receives a small stream from the west, which is the outlet of Ball Lake, a pond-like body of water a mile west of Hamilton. Fish Creek has many ditches and springs along its course, so that its volume rapidly increases. For a mile in its upper course the creek has been ditched

and straightened, but below this the channel is very crooked, swinging from side to side across the bottom land. The bluffs bordering the bottom lands are at some places 20 to 25 feet high. The creek was examined for a distance of 2 miles from its source down. The bottom is mostly sand; at some places it is covered with coarse gravel or rocks, while in the woodland the bottom is mud. The current is rapid, and the depth of water was nowhere more than 4 feet.

Everywhere in shallow water the bottom of the channel is covered with water-weeds and algæ. Lizardtail is the commonest plant along the water's edge. Several service-berry trees were noticed upon the banks.

Fish Creek was again examined near Edgerton, Williams County, Ohio, July 28. One mile north of Edgerton, where the investigations were made, this stream was 20 to 25 feet wide, and the clay banks had a height of about 5 feet. The bottom of the channel is also of clay and where not covered with sand or gravel is very slippery. The water, on account of recent rains, had a yellowish color. The stream is almost free from vegetation.

BIG RUN.

Big Run, near Butler, Ind., July 29: One mile north of Butler, where this stream was examined, it had a current on the riffles about 3 feet wide and not more than 3 inches deep. There are several stretches of quiet water, which had a depth of 3 to 4 feet, and contained many bullheads and small-mouthed black bass. One of the latter weighed half a pound. The bottom is clay or mud and notably clear of vegetation. Big Run has its origin among large springs 8 or 10 miles northwest of this place, and, after flowing southeast some 5 or 6 miles, empties into the St. Joseph River.

INDIAN LAKE.

Indian Lake, near Waterloo, Ind., July 15: This body of water lies 12 miles northwest of Waterloo. It has a length, east and west, of one-half to three-fourths miles and is about one-eighth mile wide. In most places the shores are lined with *Nuphar* and *Nymphæa*, *Myriophyllum*, *Chara*, and algæ. Its banks are marly on the north side, muck elsewhere.

Mr. Anthony Zonker measured the lake some years ago and found it 45 feet deep at its upper end, which agrees with our measurements. The depth near the lower end was 60 feet. Further toward the center, 28 feet, with a bottom temperature of 55°. At about the middle the depth was 55 feet, with a temperature of 48°.

Indian Lake is fed by a small stream which enters from the north, and its outlet is a sluggish ditch at the east end.

CEDAR LAKE.

Cedar Lake, 4½ miles northwest of Waterloo, Indiana, July 14: This lake has a length of about half a mile from north to south, and is one-eighth of a mile wide. Formerly it was perhaps a third larger, but its area has been decreased by ditching the outlet. There is muck bottom everywhere. Cedar Creek, the outlet, has some gravel. The lake is margined with marsh, the water's edge is filled with lily pads, mostly *Nuphar*, also *Nymphæa* in abundance, *Potamogeton*, *Myriophyllum*, and various algæ. *Lemna* is very abundant. The land around the lake is timbered with, in order of abundance, beech, gray ash, ironwood, slippery elm, dogwood, hawthorn, white oak, red oak, cherry, hickory. There are many willows at the lower end of the lake.

The water was warm at the surface, having a temperature of 86°, and was somewhat stained from the presence of vegetation. The temperature near its outlet, in 14 feet of water, was 74°; in 22 feet of water, 67°; nearer the center of the lake, in 25 feet of water, 61°; near the upper end, in 25 feet of water, 52°. This last measurement was probably near springs. On the west side, near the middle of the lake, in water 25 feet deep, the temperature was 61°; near by, in 22 feet of water, it was 62°. At a spring back in the woods a short distance on the east shore the temperature was about 51°. There are undoubtedly many springs in the bottom and the lake is mostly supplied from that source.

CEDAR CREEK.

Cedar Creek rises a short distance above Indian Lake, and after flowing through that lake and Cedar Lake it continues in a southeasterly direction and flows into the St. Joseph River at Cedarville, in Allen County, Ind.

Cedar Creek was fished, July 15, at a point 1½ miles above Cedar Lake. Here it has an average width of about 10 feet, an average depth of 8 inches, but with a slow rate of current. The bottom is mostly mud, but gravelly on the riffles.

Cedar Creek was examined from the outlet at Cedar Lake down to a point 2 miles below Waterloo, a distance of about 7 miles, July 17 and 18. The first 2 miles from the lake down the channel has been ditched and straightened so that the water has an average depth of about 10 inches. In the remainder of the course examined the channel is very crooked, with many deep holes and frequent gravelly shoals. At the outlet of Cedar Lake this creek had a width of 12 feet, an average depth of 10 inches; rate of current of one-third foot per second. Cedar Lake at this time, therefore, discharged 1,500 gallons of water per minute. Temperature at the bottom of this water, 68°; in the air at 9 a. m., 76°.

At several places the channel has much driftwood which obstructs the passage of fish, and it should therefore be removed. During floods the bottom lands are said to overflow to a depth of 2 feet.

In the channel were found algæ (*Nostoc* and *Spirogyra*), lizardtail in full bloom, ditch grass, and marsh cress. On the banks were seen ground ivy, purple vervain, button bush, horseweed, bulrushes, common thistle, teasel, elder, yellow dock, horsetail (*Equisetæ*), and numerous willows.

MILL CREEK.

Mill Creek, a few miles southeast of Indian Lake, July 15: This little stream was fished just below Mr. Wert's mill pond, of which it is the outlet. It has but a small current. The bottom is gravel or mud and the water is warm and not very clean. This stream empties into Cedar Creek.

ST. MARYS RIVER.

St. Marys River is formed by the confluence of several creeks in the southern part of Auglaize County, Ohio. After a northwesterly course through Mercer and Van Wert counties it enters Indiana and crosses Adams County and flows to Fort Wayne in Allen County, where it joins the St. Joseph River. It has no large tributaries. It was investigated at the following places:

The St. Marys River was examined immediately above the city of St. Marys, in Auglaize County, Ohio, August 3. The channel has an average width of about 30 feet. The banks are 7 or 8 feet high. The current is mostly sluggish. We found only one riffle, and on this the water was contracted into a stream 5 feet wide and only a

few inches deep. The bottom of the channel, as well as the banks, is composed of bluish clay and the water, in consequence, had a whitish color. In the city, and some distance below, the water was foul with the refuse from the strawboard works, and what few fish inhabited it were not fit to eat. Temperature of the air, 90°; of the water at a depth of 3 feet, 80°.

The Miami and Erie Canal crosses the river just south of St. Marys. This canal is fed from the Grand Reservoir, which has a width of 4 miles and a length of about 8 miles. Near St. Marys, where the canal is fed from this reservoir, is a lock which gives a fall of water of 8 feet. Between this point and where the canal crosses the river is another lock which has a fall of 7 feet, and where the canal crosses the river the surface of the water in the canal is 18 feet above that in the river below. Therefore, the surface of the water in the Grand Reservoir is 33 feet higher than that in the St. Marys River.

Vegetation was very abundant. Pondweed and arrow-leaf were common. At several places water willows were so dense as to almost blockade the stream. Along the margin of the stream were numerous patches of false dragon-head and horseweed.

The St. Marys River was examined at Rockford, Mercer County, Ohio, August 1 and 2. Here the river was fished for a distance of 2 miles. The channel is from 35 to 40 feet wide; the bottom is soft and everywhere covered with wood, making seining very difficult. There are long stretches of quiet water, which is 18 to 20 inches deep. Few riffles. There is no rock exposed in the channel, but we were informed that 3 miles farther down the water flows over solid limestone rock. The banks of the channel are about 8 feet high. The land along the river is covered with timber, mostly oaks, maples, elms, hickory, sycamore, beech, walnut, and willows.

The St. Marys River was examined at Decatur, Ind., July 31 and August 1. Above the city the channel is of limestone; nearer the city it is gravelly or sandy. Where the measurements were taken the stream was 50 feet wide, had an average depth of 6 inches, and a rate of current of 0.85 feet per second. This gives a volume of 9,500 gallons per minute. The temperature of the water at this point was 76°. The water was not very clear. The channel is free of vegetation. Along the water's edge were horseweed, fog fruit, cocklebur, morning-glory, and white snakeroot.

The St. Marys River was examined at Fort Wayne, Ind., August 14.

GORDON CREEK.

Gordon Creek is a northern tributary to the Maumee River, and it empties into the river a short distance below Cecil, Defiance County, Ohio. Prof. Meek says of Gordon Creek that it is a small stream, and in the summer it becomes nearly dry, with little or no running water in it. The seining was done by him in a few holes by the roadside about 1 mile above its mouth, and at Cicero, 10 or 12 miles farther up the creek. At the latter point the creek is little more than a small brook, with muddy bottom, with occasional stretches of sand.

Farlow's Pond, a small body of water covering about half an acre, during high water communicates with Gordon Creek by means of ditches. This pond was also seined by Prof. Meek.

LOST CREEK.

Lost Creek is also a northern tributary of the Maumee River, in Defiance County, Ohio. Prof. Meek described it as being larger than Gordon Creek, with sandy bottom, and that, as it is fed by springs in the upper part of its course, it is seldom, if ever, without running water.

TIFFIN RIVER.

Tiffin River has its origin in Devils Lake in Lenawee County, Mich. It flows in a southerly direction through Fulton, Williams, and Defiance counties, Ohio, and joins the Maumee River near the city of Defiance. It has no large tributaries. This river was examined at the following places:

Devils Lake, at Manitou Beach, Mich., July 25: The surface of this lake has been raised 20 inches by filling in the outlet, thereby extending the area at least one-eighth. The lake is in the form of the letter T, with the stem of the letter extending toward the north and the cap of the letter extending east and west. The greatest length from north to south is 4 miles, and the greatest width $2\frac{1}{2}$ miles. On the outer border of the east arm is Round Lake, which has a diameter of 1 mile. This is connected with the east arm by two channels, each about 10 feet wide and 100 feet long. One of these channels is shallow, not more that 1 foot deep, while the other has a depth of 5 feet, and is used for the passage of small steamboats. Round Lake is shallow and bulrushes appear almost over its entire surface.

The deepest water found in Devils Lake is in the north end of the main stem and only 100 yards from the shore, where it is 50 feet deep and has a bottom temperature of 66°. Temperature just below the surface was 79°; that of the air (10 a. m.), 78°. The greater portion of the lake is shallow, and the surface is covered with bulrushes. The shores are mostly clean, with solid bottom. The east shore is covered with innumerable shells of water snails. Mussels are very common. The country surrounding the lake is rolling and near the shores is covered with timber. Devils Lake has no inlet of any consequence; it receives nearly all its water from rains and springs.

The Tiffin River was examined at Manitou Beach, July 26. This stream is the outlet of Devils Lake. It was fished for only a few hundred yards from the lake down. The channel has a soft mud bottom and is everywhere overgrown with weeds and dense growths of algæ. Its average width was $8\frac{2}{3}$ feet; average depth, 8 inches; rate of current, 6 inches per second. The volume of water discharged from Devils Lake at this time was 1,300 gallons per minute. The surface of the water was 20 inches lower than that of the lake of which it is the outlet. Here were caught a great many mud minnows, stone cats (*Noturus gyrinus*), and dogfish.

The Tiffin River was examined at Hudson, Mich., July 22. From the dam down for 2 miles the channel has a width of 15 to 20 feet; the banks are from 4 to 6 feet high. The bed of the stream is clean, mostly of coarse gravel. There are many long riffles and few deep holes. The water is rather clear and cool. Where the measurements were taken the stream had a width of $8\frac{1}{2}$ feet, the average depth was 4 inches, and the rate of current $1\frac{1}{4}$ feet per second. The volume of water conveyed was therefore 1,590 gallons per minute. About a mile below Hudson the river receives several strong springs and the water is much cooler. Immediately below these springs we took several specimens of *Rhinichthys atronasus.*

The dam in Tiffin River just above Hudson is 6 feet high. The dam $2\frac{1}{2}$ miles below Hudson has a height of 12 feet; it has two falls, the upper of which is 8 feet. Neither of these dams is provided with fish-ladders.

The bottom lands vary in width from $\frac{1}{4}$ to 1 mile. The hills bordering the bottom lands are 20 to 30 feet high. At points where the river touches the side hills the ascent is almost perpendicular, exposing layers of gravel and bluish clay.

The ox-eyed daisy and Canada thistle are very common upon the banks. The common lizardtail is the commonest plant in the edge of the water.

The Tiffin River was fished at a point 6 miles southeast of West Unity, Ohio, July 27. Here the river is about 40 feet wide; the almost perpendicular banks are from 6 to 9 feet high and expose bluish clay with strata of gravel. The bed of the channel is also clay and full of snags, making it very difficult seining. The Tiffin is mostly a sluggish stream with a maximum depth of 6 feet. The water was roily from recent rains. Width of stream, 38 feet; average depth, 9 inches; rate of current, 1.3 feet per second. This gives a flow of 16,600 gallons of water per minute. The temperature of water at a depth of 3 feet was 80°. The bottom land at this place is broad and fertile and not so rolling as higher up the stream.

The Tiffin River was next examined at Brunersburg, a small village 2 miles northwest of Defiance, Defiance County, Ohio, August 18. The bottom of the river is of limestone (Devonian), and along the banks are outcrops of shale. The banks of the river are about 10 feet high, and the bluffs bordering the bottom land are 20 to 25 feet high. From the bridge at Brunersburg down to the mouth of the river, a distance of 2 miles, the water has an average depth of about 3 feet and but little current. At Brunersburg below the old dam are broad riffles overgrown with weeds. At the bridge, one-fourth of a mile above the mouth of the river, the channel is 204 feet wide.

AUGLAIZE RIVER.

The Auglaize River is formed in the southwest part of Allen County, Ohio. It flows first southwest through the city of Wapakoneta; thence northerly through Allen, Putnam, and Paulding counties. At Defiance, in Defiance County, it empties into the Maumee River 1 mile below and opposite the mouth of the Tiffin River. The Auglaize River differs from the other branches of the Maumee River in having numerous important tributaries. The most important of these are the Blanchard River, Sugar and Hoaglin creeks. Each of these streams was examined.

The Auglaize River was examined at Wapakoneta, Ohio, August 4. At this place the river has a varying width of 40 to 80 feet, with banks 5 feet high. The solid bed of the river is smooth, but occasionally covered with loose rocks and near the city with tin cans and other refuse. The current is mostly sluggish; few riffles. The channel in shallow water is thickly covered with riverweed. There are also occasional patches of pondweed and algæ. Many willows skirt the stream and overhang the water.

The Auglaize River was investigated near Cloverdale, Putnam County, Ohio, August 9 and 10. Here the stream was examined from the mouth of Sugar Creek down to that of the Blanchard River, a distance of 4½ miles. The width of the Auglaize River just before receiving Sugar Creek is 71 feet, and Sugar Creek at its mouth is 80 feet wide. The Auglaize River below their junction has a width of 105 feet. While Sugar Creek has somewhat the wider channel, the Auglaize had the greater volume of water. Auglaize River, 4½ miles below the mouth of Sugar Creek, receives the Blanchard River from the east. The Auglaize and Blanchard rivers were both measured immediately above their confluence and each was found to be 119 feet wide, and each had an average depth of about 15 inches. Neither of these streams, by the nature of their confluence, offers advantages over the other to the passage of fish. Just below the junction of the two rivers the Auglaize has a width of 140 feet. Here the temperature at the bottom of 5 feet of water was 76°; near the surface, 79°; in the air, 91°.

At places the bottom is limestone (Upper Silurian); at others coarse gravel or sand. The banks of the channel are from 8 to 10 feet high, and where the channel touches the hills that border the bottom lands the banks have a height of about 25 feet. The lower 5 feet of the banks expose a bluish clay, and the portion above this clay is composed of strata of clay and gravel. The dam is about midway between the mouth of Sugar Creek and that of the Blanchard River. The maximum depth is 6 feet, with smooth limestone bottom. The dam is 7 feet high and has no fish-ladder. The pool below was 4 feet deep and contained great numbers and many species of fishes.

Wrackweed, water willow, and dartweed are common plants in shallow water and damp places. Algæ very common. Horseweed is very common upon the banks and low bottom lands. Willows skirt the streams.

The Auglaize was examined at Oakwood, Paulding County, Ohio, August 12. The bed of the river is limestone (Upper Silurian). The small quantity of water upon the riffles has no distinct current, but steals its way through the dense growth of wrack-weed which fills the channel. Above and below the town of Oakwood the channel is deeper and contains more water.

The Auglaize River was next investigated at a point 2½ miles south of Defiance, Ohio, August 17. The bottom of the channel is of shale or soapstone, which is smooth and slippery. At places the river has cut its channel into this shale so that the lower 2 or 3 feet of its banks are shale. The remainder of the bank is composed of layers of yellow and bluish clays. The river is mostly shallow, with a slow current. Only one riffle was seen and here the stream had a width of about 10 feet, and was 2 or 3 inches deep. At Defiance, just before entering the Maumee River, the Auglaize has a width of 334 feet and is 15 feet deep, with a bottom temperature of 76°.

Water willow and wrackweed are the commonest of water-plants.

SUGAR CREEK.

Sugar Creek originates in the eastern part of Allen County, Ohio. It flows south-west to within 2 miles of Lima, Ohio, where it takes a west of north course to within a few miles of Cloverdale, Ohio, where it empties into the Auglaize River.

Sugar Creek was first examined 2 miles north of Lima, Ohio, August 5. The channel is 15 feet wide; the bottom and banks are of Upper Silurian limestone. The bottom at places is as smooth as a planed floor. The stone is quarried for building purposes, and is said to be of excellent quality. In holes was found considerable water; the riffles were almost dry. One of the springs near the bank is strongly impregnated with hydrogen sulphide. In shallows were seen large patches of river-weed, some pondweed, and dartweed.

Sugar Creek was again examined at its junction with the Auglaize River, near Cloverdale.

LOST CREEK.

Lost Creek was examined 1½ miles east of Lima, Allen County, Ohio, August 5. It had no flow of water upon the riffles, but in many places the water was 2 feet deep and contained many small fish and great numbers of crawfish. The water is warm and tainted with oil which finds its way into the stream from the neighboring oil wells. Several draws were also made with the seine in the dam, but with no good results. The bottom of the dam is soft mud thoroughly saturated with oil. The dam has a height of 7 feet, but at present no water flows over it. This dam serves as a reservoir for the Lima waterworks. Lost Creek empties into Sugar Creek.

BLANCHARD RIVER.

Blanchard River is formed near Kenton, in Hardin County, Ohio; it flows north to within a few miles of Findlay, Ohio, then west through the city of Findlay to the western part of Putnam County, and empties into the Auglaize River.

The Blanchard was examined at a point 3 miles east of Findlay, Ohio, August 7. The channel is from 60 to 70 feet wide; its banks are either sloping or perpendicular and about 6 feet high. The bottom is of limestone (Upper Silurian), which is very uneven and covered with innumerable rocks of all shapes and sizes from that of a few pounds to many hundredweight. Above the dam there was but little flow of water over the riffles, while below the dam there was no current at all.

The dam mentioned here is $1\frac{1}{2}$ miles east of Findlay and was constructed for a reservoir for the Findlay waterworks. The water in this dam is clear and warm. At a depth of 3 feet it had a temperature of 81°, while that of the air was 76°. This dam has a height of 8 feet and is without a fish-ladder.

Riverweed and lizardtail are the commonest of water-plants.

The Blanchard River was next examined at Ottawa, Putnam County, Ohio, August 8. The river is 50 to 60 feet wide; its banks are 6 to 10 feet high. The hills bordering the bottom lands are about 25 feet high. The banks, as well as the bottom of the channel, are of whitish clay. In some places the bottom is covered with sand and fine gravel. The stream is remarkably clear from rubbish. Just below Ottawa the stream was 14 feet wide, the average depth $1\frac{3}{4}$ inches, and the rate of current $1\frac{1}{7}$ feet per second. The volume of water, 1,000 gallons per minute. Temperature at the bottom of 3 feet of water was 73°.

Water willows and dartweed are common in the channel. Willows skirt the stream.

The Blanchard was investigated at its mouth near Cloverdale, Ohio, August 9.

HOAGLIN CREEK.

Hoaglin Creek rises near Fort Wayne, Ind., flows southeast to within a few miles west of Van Wert, Ohio, then takes a northeast course to a point 2 miles northwest of Oakwood, Paulding County, Ohio, where it empties into the Maumee River.

August 11 this stream was fished for some distance above its mouth. The channel is 80 feet wide, with limestone bottom. The banks, which are about 10 feet high, are composed of whitish clay. There is considerable deep water, but upon the riffles, which are numerous, the water is contracted into several small streamlets. The water was warm and somewhat muddy. Wrackweed was very common in the water.

BEAVER CREEK.

Beaver Creek, near Grand Rapids, Ohio: This stream has its origin in the north part of Henry County, Ohio. It takes a northerly course and flows into the Maumee River one-half mile below Grand Rapids, Wood County, Ohio. Beaver Creek was examined from the mouth up for 3 miles August 23. The bed is solid limestone, except at its mouth, where this rock is overlaid with sandstone. The channel is 20 to 25 feet wide; the banks have a height of about 6 to 8 feet and expose a bluish clay. No water flowed over the riffles, but there are many pools that contain an abundance of fish. As the course of the stream is mainly through woodland the water is cool.

Snapping turtles are numerous. Several were taken that weighed 10 pounds apiece. Many frogs were also taken.

FISHES OF THE MAUMEE RIVER BASIN.

The following abbreviations are used in noting the distribution of fishes:

Ft. Maumee, St. Joseph, and St. Marys rivers, at Fort Wayne, Ind.
MA. Maumee River, at Antwerp, Ohio.
MCl. Maumee River, at Cecil, Ohio.
MD. Maumee River, at Defiance, Ohio.
MG. Maumee River, Grand Rapids, Ohio.
MW. Maumee River, Waterville, Ohio.
T. Maumee River, Toledo, Ohio.
JH. St. Joseph River, Hudson, Mich.
JE. St. Joseph River, Edgerton, Ohio.
FL. Fish Lake, Hamilton, Ind.
FH. Fish Creek, Hamilton, Ind.
FE. Fish Creek, Edgerton, Ohio.
BR. Big Run, Butler, Ind.
IL. Indian Lake, Waterloo, Ind.
CL. Cedar Lake, Waterloo, Ind.
CC. Cedar Creek, Waterloo, Ind.
MC. Mill Creek, near Waterloo, Ind.
MM. St. Marys River, at St. Marys, Ohio.
MR. St. Marys River, at Rockford, Ohio.
MDe. St. Marys River, at Decatur, Ind.
GC. Gordon Creek, near Cecil, Ohio.
LCr. Lost Creek, near Cecil, Ohio.
DL. Devils Lake, Manitou Beach, Mich.
TB. Tiffin River, Manitou Beach, Mich.
TH. Tiffin River, Hudson Mich.
TW. Tiffin River, West Unity, Ohio.
TBr. Tiffin River, Brunersburg, Ohio.
AW. Auglaize River, Wapakoneta, Ohio.
AC. Auglaize River, Cloverdale, Ohio.
AO. Auglaize River, Oakwood, Ohio.
AD. Auglaize River, Defiance, Ohio.
SL. Sugar Creek, Lima, Ohio.
SC. Sugar Creek, Cloverdale, Ohio.
LC. Lost Creek, Lima, Ohio.
BF. Blanchard River, Findlay, Ohio.
BO. Blanchard River, Ottawa, Ohio.
BC. Blanchard River, Cloverdale, Ohio.
HC. Hoaglin Creek, near Oakland, Ohio.
BCr. Beaver Creek, Grand Rapids, Ohio.
E. West end of Lake Erie.*

1. **Acipenser rubicundus** Le Sueur. *Lake Sturgeon.* Several specimens were seen in the Columbia City (Ind.) fish-markets, which were taken in the west end of Lake Erie.
2. **Lepisosteus osseus** (Linnæus). *Long-nosed Gar-pike.* Ft., MG., MW., T., FL., DL., AC., AD., BO., HC., BCr.
3. **Lepisosteus platystomus** Rafinesque. *Short-nosed Gar-pike.* A single specimen, about 1 foot in length, was taken in the Maumee River at Toledo, Ohio.
4. **Amia calva** Linnæus. *Mudfish; Dogfish.* One specimen from the Maumee River at Toledo, Ohio, and many from the Tiffin River at Manitou Beach, Mich. Said to be common in the lakes.
5. **Ictalurus punctatus** (Rafinesque). *Channel Cat.* Ft., MD., MG., MW., T., MR., MDe., TBr., AC., AO., AD., BO., HC., SC., BCr. Found most common in the lower courses of the larger streams. Especially abundant in the Maumee River at Toledo, Ohio, where large numbers are taken with hand lines. The largest specimen was taken in the Maumee River at Grand Rapids, Ohio; it weighed 3¼ pounds.
6. **Ameiurus natalis** (Le Sueur). *Yellow Cat.* MA., MD., MG., MW., TB., TBr., SL., LC., BF., BO., BCr. Seemingly scarce at all these points. None taken by us is over 4 inches long.
7. **Ameiurus nebulosus** (Le Sueur). *Bullhead.* Taken at all places where investigations were made except at MA., MD., MG., T., MR., LC., BO., BCr., E. Rather common wherever found.
8. **Ameiurus melas** (Rafinesque). Taken in the Maumee River at Cecil, Ohio; the St. Joseph River at Hudson, Mich.; the St. Marys River at Rockford, Ohio; the Tiffin River at Hudson, Mich.; and Cedar Creek at Waterloo, Ind.
9. **Noturus flavus** Rafinesque. *Yellow Stone-cat.* Ft., MD., MG., MW., JH., FH., FE., MR., MDe., AC., AD., SC., BO., HC., BC. Generally common. Very common in the St. Marys River at Decatur, Ind., where the largest specimen secured measured 11 inches.
10. **Noturus exilis** Nelson. One specimen from the Tiffin River at Manitou Beach, Mich.
11. **Noturus miurus** Jordan. Ft., MA., JE., FH., CC., MR., MDe., TB., TH., TW., TBr., AC., AO., AD., SC., BF., BO., HC. In an old millrace which empties into Tiffin River near West Unity, Ohio, large numbers were caught. Also common in the St. Marys River at Decatur, Ind., and in Hoaglin Creek near Oakwood, Ohio. Rather scarce at all other points examined by us. The specimens from the Maumee River at Antwerp, Ohio, approach inc oloration *N. eleutherus.*

* I have included in the list such Lake Erie species as I have observed from time to time in the Columbia City fish markets. While some of these have not been taken by me in the Maumee Basin, all of them doubtless enter the mouth of the Maumee River at times.

12. **Noturus gyrinus** (Mitchill). Ft., T., FH., MM., TB., DL. Everywhere scarce except in the Tiffin River, at Manitou Beach, Mich., where more than a dozen specimens were caught from among weeds in sluggish water. The largest specimen taken was from this point, and measured 2½ inches in length.

13. **Carpiodes velifer** (Rafinesque). *Carp Sucker.* Ft., MA., MD., MG., T., TBr., AC., AO., AD., BO., BC., HC., BCr. Rather common at all these points. The largest were taken in the lower course of the Maumee River.

14. **Catostomus teres** (Mitchill). *Fine-scaled Sucker; "Black Sucker."* Taken by us throughout the Maumee River Basin, except at the following places: MA., MD., FL., IL., MR., TB., TBr., DL., AO., AD., MC., E. This is a common fish, and no doubt inhabits all the waters of this river system. It is taken with hook and line in the spring as soon as the ice leaves the streams.

15. **Catostomus nigricans** Le Sueur. *Hog Sucker.* Taken by us at all points examined, except T., MM., MR., TB., SL., LC., MC., LCr., GC., E. Rather common, and generally taken in clear swift currents. None taken in any of the lakes.

16. **Erimyzon sucetta** (Lacépède). *Chub Sucker.* T., JE., CC., MM., MDe., TW., LCr., GC. Scarce at all these points. The largest specimen, 7¼ inches long, was taken in St. Marys River, at St. Marys, Ohio.

17. **Minytrema melanops** (Rafinesque). *Striped Sucker.* Ft., MG., JH., JE., FH., FE., CC., MM., MR., MDe., AW., AC., BF. Common only at the last two places named. The largest specimen was caught in Fish Creek at Hamilton, Ind., and measured 7 inches. Striped suckers were not found in any of the lakes.

18. **Moxostoma anisurum** (Rafinesque). *White-nosed Sucker.* Ft., MA., MD., T., MDe., TW., TBr., AC., AO., AD., BO., HC., BCr. Not scarce at any of these places. The largest specimen, 10 inches in length, was caught in the Maumee River at Antwerp, Ohio. D. 15 or 16.

19. **Moxostoma macrolepidotum duquesnei** Le Sueur. *Common Redhorse; White Sucker.* This common fish was taken at all places examined except MD., BR., MR., TB., AO., SL., MC., E. It no doubt inhabits all the streams in this basin. The largest caught were about 12 inches long. D. 13; A. 7. None of this species was taken in the lakes.

20. **Moxostoma aureolum** (Le Sueur). *Lake Redhorse.* MD., MG., MW., JE., E. Common at all these points. It is valued as a food-fish in the lower Maumee River, where large numbers are taken with hook and line in early spring. Head in body, 5½; D. 14 (one 13). The largest, 3¼ pounds, was caught in the Maumee River at Defiance, Ohio.

21. **Lagochila lacera** Jordan & Brayton. *Harelip Sucker.* AC., BO. At the former place one specimen, 5 inches long, and at the latter many smaller ones. Head, about 5; depth, 4¼. D. 12.

22. **Cyprinus carpio** Linnæus. *German Carp.* T., CL., MR., TW., E. Very abundant in the Maumee River at Toledo, Ohio, and in west end of Lake Erie. Scarce at the other points named.

23. **Cyprinus carpio coriaceus** Linnæus. *Leather Carp.* One small specimen each from the Maumee River at Toledo, Ohio, and from the Tiffin River at West Unity, Ohio.

24. **Campostoma anomalum** (Rafinesque). *Stone-roller.* Ft., MA., MD., MG., JH., JE., FH., FE., BR., CC., TH., TW., DL., AW., AC., SL., BO., BC., GC., BCr. Generally common in clear pools below riffles. A single specimen was taken from Devils Lake. None were caught in the other lakes. Not one specimen was caught in the St. Marys River. D. 8; A. 7.

25. **Chrosomus erythrogaster** Rafinesque. *Red-bellied Minnow.* The specimens here noted were collected by Prof. Meek in Lost Creek, near Defiance, Ohio.

26. **Pimephales promelas** Rafinesque. MCl., FH., LCr., GC., TH., SL. Scarce. Lateral line imperfect; a black bar across middle of dorsal. Head, about 4; depth, 4½. D. I, 7; A. 7.

27. **Pimephales notatus** (Rafinesque). *Blunt-nosed Minnow.* A common little fish caught at all points where investigations were made, except the following: MC., DL., CL., TB., E. It is no doubt found in these waters also.

28. **Notropis cayuga** Meek. A few specimens from the Maumee River at Toledo, Ohio, and many from Devils Lake, Manitou Beach, Mich. Head, 4 to 4¼ in length of body; depth, about 4½. Eye, about 3¼ in length of head. Mouth oblique. First ray of dorsal somewhat nearer snout than to base of caudal fin. Pectoral fins not quite reaching base of ventrals. Lateral line incomplete. Scales in lateral line, 36 to 38. The dark lateral bands pass forward and meet on the upper jaw in front. D. 8; A. 7 or 8.

29. Notropis heterodon (Cope). Taken nowhere except in Fish Lake at Hamilton, Ind., where many specimens were secured. None over $2\frac{1}{2}$ inches long. Lateral line not complete. Lateral dark bands pass forward through the eyes and meet on both jaws in front. Head, 4 to $4\frac{1}{3}$ in length of body; depth, about 4. Eye somewhat longer than snout. Insertion of first dorsal ray nearer tip of snout than to base of caudal fin. Caudal peduncle long and slender. Coloration dark. D. 8; A. 8.

30. Notropis deliciosus (Girard). Ft., MA., MCl., MD., MW., TBr., AC., SC., BO., GC., BCr. Rather scarce at all these points. The two specimens from Maumee River, Cecil, Ohio, are given by Prof. Meek as var. *microstomus* (Rafinesque) and those from Gordon Creek as var. *volucella* Cope.

31. Notropis boops Gilbert. Common in the Maumee River at Grand Rapids. Five specimens from the Blanchard River at Findlay, Ohio. Eye longer than snout and $2\frac{1}{2}$ in length of head.

32. Notropis hudsonius (De Witt Clinton). Very common in the Maumee River at Grand Rapids, Ohio, where the largest specimens measured $2\frac{1}{2}$ inches in length. A single specimen, $3\frac{1}{2}$ inches long, was secured in the Maumee River at Toledo, Ohio. Numerous specimens were taken in Devils Lake and Tiffin River at Manitou Beach, Mich.

33. Notropis whipplei (Girard). *Silver-fin.* Taken throughout the Maumee River Basin, except at the following places: BR., IL., CL., TB., TH., MC., GC., E.

34. Notropis megalops (Rafinesque). *Common Shiner.* Taken in all the streams and at nearly every point where investigations were made. None found in the lakes.

35. Notropis ariommus (Cope). *Big-eye.* Two specimens, $2\frac{5}{8}$ inches long, from the Maumee River at Antwerp, Ohio. Eye, about $2\frac{1}{2}$ in length of head; head, 4 in body. Jaw, oblique; maxillary extending to front of eye. Front of dorsal midway between tip of snout and base of caudal fin. D. 8; A. 8.

36. Notropis ardens (Cope). *Redfin.* Found at all points in the streams explored, except at MCl., T., JE., MR., TB., TH., MC. This includes the specimens taken in Lost and Gordon creeks, near Cecil, Ohio, by Prof. Meek, and classed by him as *Notropis lythurus* Jordan & Gilbert. Dr. D. S. Jordan says, in Manual of Vertebrates, that *Notropis ardens* is very variable, but the different varieties (*lythurus, atripes, cyanocephalus*) are hardly worthy of separate names; we have therefore classed all under the name *N. ardens* (Cope).

37. Notropis dilectus (Girard). Ft., JH., JE., CC., TH., BF., BCr. Common at all these places. Head, about $4\frac{1}{2}$; depth, $4\frac{1}{2}$. D. 9; A. 10.

38. Notropis atherinoides Rafinesque. Ft., MCl., MG., T., JH., JE., CC., TH., TBr., AW., AO. Not common at any of these places.

39. Notropis arge (Cope). MG., JE., TBr. Scarce. Distinguished from the former in having a slenderer body and a much larger eye.

40. Ericymba buccata Cope. Taken at all places in the streams except MCl., CL., TB., TW., TBr., AW., LC., MC. A single specimen from Indian Lake, Waterloo, Ind. None was found in any of the other lakes.

41. Rhinichthys atronasus (Mitchill). *Black-nosed Dace.* Common in the St. Joseph River near Hudson, Mich. Specimens were taken in cold water in the Tiffin River at Hudson; and several from Lost Creek, near Cecil, Ohio, by Prof. Meek. Found nowhere else.

42. Hybopsis amblops (Rafinesque). This little minnow was found in all the larger streams examined and in nearly all the smaller tributaries. It no doubt inhabits all the streams. It was not found in the lakes.

43. Hybopsis kentuckiensis (Rafinesque). *River Chub.* Caught in none of the lakes, but specimens were secured at every point in every stream examined except in Mill Creek near Waterloo, Ind. Especially common and of large size in the larger streams. The largest specimen secured was $7\frac{1}{2}$ inches long.

44. Semotilus atromaculatus (Mitchill). *Creek Chub.* Generally distributed throughout the Maumee Basin, but not quite so abundant as the former. It inhabits swift currents in the smaller streams. Many small specimens were caught in cold water in Fish Lake at Hamilton, Ind. None was found in the other lakes.

45. Opsopœodus emiliæ Hay. Two small specimens from the St. Marys River at St. Marys, Ohio, $2\frac{1}{8}$ and $1\frac{3}{4}$ inches long. Mouth very small and very oblique; eye longer than snout and 3 in length of head. Head, $4\frac{2}{3}$ and $4\frac{1}{2}$ in length of body; depth, $4\frac{2}{3}$. Front of dorsal behind insertion of ventrals and nearer tip of snout than to base of caudal fin. D. 9; A. 8. Anterior rays of dorsal dusky.

46. **Notemigonus chrysoleucus** (Mitchill). *Golden Shiner.* Taken in warm water on grassy bottom at the following points: Ft., MCl., MG., MW., T., JH., BR., CC., MM., MR., MDe., TW., AO., AD., SL., LC., BF., MC.

47. **Hiodon tergisus** Le Sueur. *Moon-eye; Silver Bass.* Taken only below the dams in the Maumee River at Defiance and Grand Rapids, Ohio. At both places they were very abundant.

48. **Dorosoma cepedianum** (Le Sueur). *Hickory Shad.* Ft., MD., MG., MM., MR., MDe., TBr., AC., AO., AD., HC., GC. Generally found on muddy bottom. All the specimens taken by us are small, none over 4 inches long.

49. **Coregonus clupeiformis** (Mitchill). *Whitefish.* Specimens taken in the west end of Lake Erie are frequently seen in the Columbia City, Ind., fish-markets.

50. **Coregonus artedi** Le Sueur. *Lake Herring; Cisco.* From the west end of Lake Erie and observed in the Columbia City fish markets.

51. **Fundulus diaphanus** (Le Sueur). Caught by us only in the Maumee River at Toledo, Ohio, and in Devils Lake, Manitou Beach, Mich. Abundant at both these places.

52. **Zygonectes notatus** (Rafinesque). *Top Minnow.* MG., FL., MM., MR., MDe., TW., TBr., AW., AC., AO., AD., BO., HC. Seemingly scarce at all these points.

53. **Umbra limi** (Kirtland). *Mud Minnow.* FH., FE., CC., TB., TH., MC., LCr., GC. Very common on soft, muddy bottom. Several specimens were found in the stomachs of black bass.

54. **Lucius vermiculatus** (Le Sueur). *"Grass Pike"; Little Pickerel.* Common throughout the Maumee Basin. Specimens were taken from all the waters examined, except Indian Lake and Hoaglin Creek. Most abundant in grassy and sluggish waters.

55. **Lucius lucius** (Linnæus). *Common Pike; "White Pike."* JH., JE., CL., TW., TBr., AC. Scarce at all these points. The specimen caught in the St. Joseph River, at Hudson, Mich., weighed 3¼ pounds. The stomach of this fish was filled to its utmost capacity with a sucker (*Moxostoma macrolepidotum duquesnei*), which was not less than 5 inches long. The stomachs of others were examined and were found to contain minnows, crawfish, or beetles. The white pike seems to be gradually diminishing in numbers in our streams and lakes.

56. **Lucius masquinongy** (Mitchill). *Maskalonge*, T., E. Fishermen on the lower course of the Maumee River say that formerly the maskalonge was very abundant in that stream, but that now one is seldom taken there. They are also decreasing in Lake Erie. The Toledo fishermen say that only a small number are taken by them each year.

57. **Anguilla chrysypa** Rafinesque. *Common Eel.* None were taken by us, but the skin of one was seen that was taken in the Maumee River at Defiance, Ohio. They are said to inhabit all the waters of the Maumee Basin.

58. **Labidesthes sicculus** Cope. *Skipjack; Brook Silverside.* Generally distributed in the waters of the Maumee Basin. Great numbers of these small fish inhabit the Indiana lakes, where they constitute a large portion of the food supply of the bass and other food-fishes.

59. **Aphredoderus sayanus** (Gilliams). *Pirate Perch.* Only two small specimens were taken; one by Prof. Meek in Gordon Creek, near Cecil, Ohio, and one by us in warm sluggish water in St. Marys River, at Rockford, Ohio.

60. **Pomoxis sparoides** (Lacépède). *Calico Bass.* Ft., MD., MG., JE., FL., FH., FE., CC., MM., MR., MDe., TW., TBr., HC. Taken in none of the lakes except Fish Lake, where we found it very common. None was caught in the Auglaize and the Blanchard rivers, or in any of their tributaries. It is improperly called "rock bass" by the rural fishermen in northeastern Indiana.

61. **Ambloplites rupestris** (Rafinesque). *Rock Bass; Goggle-eye; Red-eye.* Two specimens were caught by us in Devils Lake, none from any of the other lakes. A common fish at nearly all the points where investigations were made in the streams except Fish Creek, Big Run, Lost Creek, near Lima, Ohio, and Lost and Gordon creeks near Cicily, Ohio. They were taken in the largest numbers and of the largest size in the St. Marys River at Decatur, Ind.

62. **Chænobryttus gulosus** (Cuv. & Val.). *Warmouth.* FL., FH., FE., IL., CC., TB. Not common anywhere.

63. **Lepomis cyanellus** Rafinesque. *Green Sunfish.* None was caught in the lakes, but specimens were taken at nearly every point in all the streams that were examined.

64. **Lepomis pallidus** (Mitchill). *"Blue-gill;" Blue Sunfish.* One of the commonest of fishes in all the lakes. Specimens were taken in all the streams and at nearly every point examined.

65. **Lepomis megalotis** (Rafinesque). Found in all the larger streams and in nearly all the smaller ones. A few specimens were taken in Devils Lake, Manitou Beach, Mich., but none from any of the other lakes. Several specimens were caught on the spawning beds in Cedar Creek at Waterloo, Ind., on July 17.

66. **Lepomis gibbosus** (Linnæus). *Common Sunfish.* Abundant in all the lakes. Common in all the larger streams, except the Auglaize River and its tributaries. Less common in the smaller streams.

67. **Micropterus dolomieu** Lacépède. *Small-mouthed Black Bass.* Common in all the streams. None was taken from the lakes. Large numbers are taken below the dams in the Maumee River at Defiance and at Grand Rapids, Ohio.

68. **Micropterus salmoides** (Lacépède). *Large-mouthed Black Bass.* A common fish in all the lakes, where they form excellent sport for the angler. Also common in the Maumee River and most of its larger tributaries. Not one was taken in the Auglaize River or in any of its tributaries. In the stomachs of black bass were found crawfish and minnows. In the stomach of one black bass was found a yellow perch (*Perca flavescens*), and in the stomach of the yellow perch, in turn, was found a mud minnow (*Umbra limi*).

69. **Etheostoma pellucidum** Baird. *Sand Darter.* Common everywhere on sandy bottom in the Maumee River and in the lower courses of the larger tributaries. None was found in the smaller streams or in the lakes.

70. **Etheostoma nigrum** Rafinesque. *Johnny Darter.* Common everywhere except in Indian and Cedar lakes, and Tiffin River at Manitou Beach, Mich.

71. **Etheostoma blennioides** Rafinesque. *Green-sided Darter.* None caught in any of the lakes, nor from St. Marys River. Taken in all the other larger streams and many of the smaller ones.

72. **Etheostoma copelandi** (Jordan). Two specimens, $1\frac{1}{4}$ inches in length, were taken in the Maumee River at Toledo, Ohio.

73. **Etheostoma caprodes** (Rafinesque). *Log Perch.* Rather common at nearly all places examined by us in all the larger streams. Specimens were also secured in most of the smaller streams. None from any of the lakes.

74. **Etheostoma aspro** Cope & Jordan. *Black-sided Darter.* Not taken in the lakes, but abundantly distributed in all the streams examined.

75. **Etheostoma evides** (Jordan & Copeland). Five specimens were caught at the confluence of the St. Marys and St. Joseph rivers, at Fort Wayne, Ind., and one specimen below the dam in the Maumee River, at Grand Rapids, Ohio. They were all taken in clear flowing water. Length, $2\frac{1}{2}$ inches; head, $4\frac{1}{2}$; depth, $5\frac{1}{2}$.

76. **Etheostoma flabellare** Rafinesque. "*Fan-tailed Darter.*" JH., FE., CC., TH., TBr., DL., SL., BCr. One specimen each from the Tiffin River at Brunersburg, Ohio, and from Devils Lake, Manitou Beach, Mich. Common at all the other points named.

77. **Etheostoma coeruleum** Storer. *Rainbow Darter.* Not one was caught in the lakes nor in the Maumee, St. Joseph, and St. Marys rivers. Common in all the larger and nearly all the smaller streams.

78. **Etheostoma coeruleum spectabile** Agassiz. "*Striped Rainbow Darter.*" Only three specimens, from Sugar Creek, near Lima, Ohio. They differ from the former in having dark streaks along the rows of scales on the back.

79. **Etheostoma jessiæ** Jordan & Brayton. Very abundant in Devils Lake and Tiffin River at Manitou Beach, Mich. Head, 4; depth, about 5. D. XII, 12. A. II, 9.

80. **Etheostoma eos** (Jordan & Copeland). One specimen from Fish Lake, four from Indian Lake, and many from the Tiffin River at Manitou Beach, Mich.

81. **Etheostoma microperca** Jordan & Gilbert. *Least Darter.* Taken only in Fish Lake, where four specimens $1\frac{1}{4}$ inches in length were secured.

82. **Perca flavescens** (Mitchill). *Yellow Perch; "Ring Perch."* MG., MW., T., FL., FH., CL., MM., TB., DL., E. Rather common. Especially abundant in the lakes and in the lower courses of all the larger streams.

83. **Stizostedion vitreum** (Mitchill). *Wall-eye; Pike Perch.* A few specimens from the Maumee River below the dam at Grand Rapids, Ohio, and numerous specimens were taken in the Maumee River at Toledo, Ohio. In Lake Erie, around the mouth of the Maumee River, large numbers of this fish are caught for the markets of Toledo and other cities. It is one of the leading food-fishes.

84. Stizostedion canadense (C. H. Smith). *Sauger; Sand Pike.* MG., MW., T., BO., E. At the first three places named numerous specimens from 5 to 14 inches in length were taken. At the last place a single specimen 13 inches long was caught. This species is distinguished from the former by the absence of a black spot on the last spines of the first dorsal.

85. Roccus chrysops (Rafinesque). *White Bass.* A few specimens from the Maumee River at Grand Rapids, five from the Maumee at Waterville, and many from the Maumee at Toledo, Ohio. None was taken anywhere above the lower dam in the Maumee River.

86. Aplodinotus grunniens Rafinesque. "*Sheepshead.*" MD., MG., MW., T., E. Abundant at these places. They are not valued for food, and the large numbers caught by fishermen in the west end of Lake Erie are thrown upon the beach, where they decay and the "lucky stones" are picked up by boys.

87. Cottus bairdi Girard. *Miller's Thumb.* JE., BR., CC. Only a few specimens from each of these places were secured. They inhabit cold water on rocky bottom.

LIST OF FRESH-WATER MOLLUSKS COLLECTED IN THE MAUMEE RIVER BASIN AND NORTHERN OHIO IN THE SUMMER OF 1893, BY A. J. WOOLMAN AND P. H. KIRSCH.

[Identified by Dr. W. H. Dall and Mr. C. T. Simpson, of the U. S. National Museum.]

Maumee River (Kirsch).
1. *Anodonta ferussaciana* Lea.
2. *Unio multiradiatus* Lea.
3. *Unio occidens* Lea.

Cedar Creek, Waterloo, Ind., July 15–17 (Kirsch).
1. *Anodonta edentula* var. Say.
2. *Anodonta decora* Lea.
3. *Anodonta footiana* Lea.
4. *Campeloma decisa* Say.
5. *Campeloma integra* Say.
6. *Limnæa stagnalis* L.
7. *Planorbis trivolvis* Say.
8. *Planorbis campanulatus* Say.
9. *Sphærium simile* Say.
10. *Sphærium striatinum* Con.
11. *Unio undulatus* var. Bar.
12. *Unio luteolus* Lam. Female.

Sugar Creek, Cloverdale, Ohio, August 10 (Kirsch).
1. *Unio circulus* Lea.

Lake Erie, Port Clinton, Ohio, July 11 (Woolman).
1. *Unio alatus* Say.
2. *Unio luteolus* Lam. Male and female, northern variety.
3. *Unio occidens* Lea. Female.
4. *Unio undulatus* Barnes.

Vermilion River, Clarkfield, Ohio, July 17 (Woolman).
1. *Unio luteolus* Lam.
2. *Unio iris* Lea.

Rock River, Elyria, Ohio, July 18 (Woolman).
1. *Unio undulatus* Bar.

Sandusky River, Tiffin, Ohio, July 19 (Woolman).
1. *Margaritana rugosa* Barnes.
2. *Unio undulatus* Bar.
3. *Unio circulus* Lea.
4. *Unio rubiginosus* Lea.

Beaver Creek, Lorain, Ohio, July 20 (Woolman).
1. *Unio asperrimus* Lea.
2. *Unio luteolus* Lam.

Grand River, Painesville, Ohio, July 21 (Woolman).
1. *Anodonta edentula* Say.
2. *Unio occidens* Lea.

Cuyahoga River, South Park, Independence, Ohio, July 25 (Woolman).
1. *Unio occidens* Lea. Female.
2. *Unio undulatus* Bar.
3. *Unio ligamentinus* var. Lam.
4. *Margaritana rugosa* Barnes.

LIST OF CRAWFISH COLLECTED IN THE MAUMEE RIVER BASIN BY P. H. KIRSCH.

[Identified by Dr. Walter Faxon.]

1. *Cambarus propinquus* Gir.
   Maumee River, 1 ♂ f. II, 2 ♀.
   Cedar Creek, Waterloo, Ind., 7 ♂ f. I, 5 ♀, 3 ♂ f. II.
   Devils Lake, Manitou Beach, Mich., 1 ♂ f. II.
   Tiffin River, Hudson, Mich., 1 ♀.
2. *Cambarus immunis* Hog.
   Maumee River, 1 ♂ f. II, 1 ♀.
   Cedar Creek, Waterloo, Ind., 1 ♂ f. I, 3 ♂ f. II.
   Beaver Creek, Grand Rapids, Ohio.
3. *Cambarus rusticus* Gir.
   Maumee River, 11 ♂ f. I, 4 ♀, 1 ♂ f. II.
   Cedar Creek, Waterloo, Ind., 5 ♂ f. I, 5 ♀.
   Auglaize River, Cloverdale, Ohio, 1 ♀ jw.
   Auglaize River, Defiance, Ohio, 1 ♂ f. II.
   Sugar Creek, Cloverdale, Ohio, 2 ♂ f. I.
   Blanchard River, Ottawa, Ohio, 1 ♂ f. I.
   Beaver Creek, Grand Rapids, Ohio, 1 ♂ f. I.

BATRACHIANS AND REPTILES OBSERVED BY US IN THE MAUMEE RIVER BASIN.

BATRACHIANS.

1. **Necturus maculatus** Rafinesque. *Mud puppy; water dog.* One specimen was seen by us in the Maumee River at Grand Rapids, Ohio. They were said to be common in the lakes and larger streams, where they are often taken with hook and line.
2. **Bufo lentiginosus** Shaw. *Toad.* Generally observed throughout the Maumee Basin.
3. **Acris gryllus crepitans** (Baird). *Cricket frog.* Very common along the margin of all the lakes. Less common but generally distributed along the streams.
4. **Rana pipiens** Schreber. *Common frog; leopard frog.* Observed at nearly all points where investigations were made.
5. **Rana sylvatica** Le Conte. *Wood frog.* A few from the St. Joseph River near Hudson, Mich.
6. **Rana clamitans** Latreille. *Green frog.* One specimen each from Cedar Creek, Waterloo, and Fish Creek, Hamilton, Ind.; St. Joseph River, Edgerton, and Sugar Creek, Lima, Ohio A few specimens each from the Tiffin and St. Joseph rivers near Hudson, Mich. Many from the Blanchard River at Findlay, Ohio.
7. **Rana catesbeiana** Shaw. *Bullfrog.* Said to be common in all the lakes and sluggish waters of the streams, but specimens were seen by us only in Cedar Creek at Waterloo, and Big Run at Butler, Ind.

REPTILES.

1. **Storeria dekayi** (Holbrook). One specimen each from Lost Creek, Lima; Auglaize River, Cloverdale; and Beaver Creek, Grand Rapids, Ohio.
2. **Thamnophis faireyi** (Baird & Girard). One specimen from near Hudson, Mich.
3. **Thamnophis butleri** (Cope). One specimen from Cedar Creek, Waterloo, Ind.
4. **Thamnophis sirtalis** (Linnæus). *Garter snake.* At Hudson and Manitou Beach, Mich., at Waterloo and Hamilton, Ind., and at Grand Rapids and Lima, Ohio.
5. **Natrix leberis** (Linnæus). A few specimens were seen at Waterloo and Hamilton, Ind., and at Lima and Findlay, Ohio.[1]
6. **Natrix sipedon** (Linnæus). *Water snake.* A common snake, but was seen by us only at the following points: Maumee River, Antwerp, Ohio; Tiffin River, Manitou Beach, and Hudson, Mich.; Auglaize River, Defiance, and Sugar Creek, Lima, Ohio.
7. **Amyda mutica** (Le Sueur). *Leather turtle.* Generally distributed. Taken by us in the Maumee River at Grand Rapids, where it was common; Tiffin River at West Unity and Brunersburg, Ohio; Auglaize River at Defiance, Lost Creek, Lima, and Hoaglin Creek at Oakwood, Ohio.
8. **Platyrettis spinifer** (Le Sueur). *Soft-shelled turtle.* Specimens were taken by us in the Maumee River at Defiance, Ohio; St. Joseph River at Edgerton, Ohio; Fish Creek at Hamilton, Ind.; Tiffin River at West Unity, Ohio; Auglaize River at Cloverdale and Oakwood, Ohio.
9. **Chelydra serpentina** (Linnæus). *Snapping turtle.* Specimens were observed in the Maumee, Defiance, Ohio; St. Joseph River, Hudson, Mich.; Cedar Creek, Waterloo, Fish Creek, Hamilton, and Big Run, Butler, Ind.; St. Marys River, Decatur, Ind.; Tiffin River, West Unity, Ohio; Auglaize River, Defiance, Ohio, and Beaver Creek, Grand Rapids, Ohio.
10. **Aromochelys odorata** (Latreille). *Musk turtle.* A single specimen from the Maumee River at Defiance, Ohio.
11. **Malaclemys geographica** (Le Sueur). *Map turtle.* Not common. Taken by us in the Maumee River at Antwerp, Defiance, and Grand Rapids, Ohio; St. Marys River at Decatur, Ind.; Auglaize River at Defiance, and Blanchard River, Ottawa, Ohio.
12. **Chrysemys marginata** (Agassiz). The commonest of turtles. Specimens were taken at almost every place where investigations were made by us.

TABLE OF DISTRIBUTION.

The following table shows the present known distribution of the 87 species of fishes which we now know from the basin of the Maumee River. The streams and places from which each species has been obtained are indicated by the crosses in the appropriate columns.

TABLE SHOWING THE KNOWN DISTRIBUTION

Number.	Species.	Maumee River.							St. Joseph River.				Fish Creek.					
		Fort Wayne.	Antwerp.	Cecil.	Defiance.	Grand Rapids.	Waterville.	Toledo.	Hudson.	Edgerton.	Fort Wayne.	Fish Lake.	Hamilton.	Edgerton.	Big Run.	Indian Lake.	Cedar Lake.	Cedar Creek.
1	Acipenser rubicundus																	
2	Lepisosteus osseus	×				×	×	×			×	×						
3	Lepisosteus platystomus							×										
4	Amia calva							×										
5	Ictalurus punctatus	×			×	×	×	×			×							
6	Ameiurus natalis		×		×	×	×											
7	Ameiurus nebulosus	×		×			×		×	×	×	×	×	×	×	×	×	×
8	Ameiurus melas			×					×									×
9	Noturus flavus	×			×	×	×		×		×		×	×				
10	Noturus exilis																	
11	Noturus miurus	×	×							×	×		×					×
12	Noturus gyrinus	×						×			×		×					
13	Carpiodes velifer	×	×		×	×		×			×							
14	Catostomus teres	×		×		×	×	×	×	×	×		×	×	×		×	×
15	Catostomus nigricans	×	×	×	×	×	×		×	×	×	×	×	×	×	×	×	×
16	Erimyzon sucetta							×		×								×
17	Minytrema melanops	×				×			×	×	×		×	×				×
18	Moxostoma anisurum	×	×		×			×			×							
19	Moxostoma macrolepidotum duquesnei	×	×	×		×	×	×	×	×	×	×	×	×		×	×	×
20	Moxostoma aureolum				×	×	×			×								
21	Lagochila lacera																	
22	Cyprinus carpio							×									×	
23	Cyprinus carpio coriaceus							×										
24	Campostoma anomalum	×	×		×	×			×	×	×		×	×	×			×
25	Chrosomus erythrogaster																	
26	Pimephales promelas			×									×					
27	Pimephales notatus	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×		×
28	Notropis cayuga							×										
29	Notropis heterodon											×						
30	Notropis deliciosus	×	×	×	×		×				×							
31	Notropis boops					×												
32	Notropis hudsonius					×		×										
33	Notropis whipplei	×	×	×	×	×	×	×	×	×	×	×	×	×				×
34	Notropis megalops	×	×	×	×	×	×	×	×	×	×		×	×	×			×
35	Notropis ariommus		×															
36	Notropis ardens	×	×		×	×	×		×		×		×	×	×			×
37	Notropis dilectus	×							×	×	×							×
38	Notropis atherinoides	×		×		×		×	×	×								×
39	Notropis arge					×				×	×							
40	Ericymba buccata	×	×		×	×		×	×	×	×		×	×	×	×		×
41	Rhinichthys atronasus								×									
42	Hybopsis amblops	×	×			×			×	×	×		×	×				×
43	Hybopsis kentuckiensis	×	×	×	×	×	×	×	×	×	×		×	×	×			×
44	Semotilus atromaculatus	×		×		×			×		×	×	×	×	×			×
45	Opsopœodus emiliæ																	
46	Notemigonus chrysoleucus	×		×		×	×	×	×		×				×			×
47	Hiodon tergisus				×	×												
48	Dorosoma cepedianum	×			×	×					×							

OF FISHES IN THE MAUMEE BASIN.

	St. Marys River.								Tiffin River.			Anglaize River.				Sugar Creek.			Blanchard River.					
Mill Creek.	St. Marys.	Rockford.	Decatur.	Fort Wayne.	Gordon Creek.	Lost Creek (Cecil).	Devils Lake.	Manitou Beach.	Hudson.	West Unity	Brunersburg.	Wapakoneta.	Cloverdale.	Oakwood.	Defiance.	Lima.	Cloverdale.	Lost Creek (Lima).	Findlay.	Ottawa.	Cloverdale.	Hoaglin Creek.	Beaver Creek.	Lake Erie.	Number.
																								×	1
																					×				2
																									3
																									4
		×	×								×		×	×	×					×		×			5
											×							×	×	×					6
×	×		×	×			×	×	×	×			×	×	×	×	×						×		7
									×																8
		×	×										×		×					×	×				9
																									10
		×	×	×					×	×	×			×	×					×					11
	×			×				×																	12
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	×		×	×	×	×				×		×	×				×	×	×	×	×				14
			×						×	×	×		×	×						×		×	×		15
	×		×		×	×																			16
	×	×	×									×	×												17
			×	×						×	×		×	×	×					×		×			18
	×		×	×	×	×	×			×	×		×				×		×		×		×		19
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					×	×										×									26
	×	×	×	×	×	×			×				×		×	×			×	×		×	×		27
							×																		28
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				×	×						×		×				×			×			×		30
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						×			×																41
		×	×								×	×		×	×				×	×					42
	×	×	×	×	×	×		×	×	×	×		×	×	×	×	×	×	×	×	×	×	×		43
		×			×				×	×						×		×					×		44
	×																								45
×	×	×	×							×				×	×	×		×	×						46
																									47
	×	×	×	×	×						×		×												48

TABLE SHOWING THE KNOWN DISTRIBUTION

Number.	Species.	Maumee River.							St. Joseph River.				Fish Creek.					
		Fort Wayne.	Antwerp.	Cecil.	Defiance.	Grand Rapids.	Waterville.	Toledo.	Hudson.	Edgerton.	Fort Wayne.	Fish Lake.	Hamilton.	Edgerton.	Big Run.	Indian Lake.	Cedar Lake.	Cedar Creek.
49	Coregonus clupeiformis																	
50	Coregonus artedi																	
51	Fundulus diaphanus							×										
52	Zygonectes notatus					×						×						
53	Umbra limi												×	×				×
54	Lucius vermiculatus	×				×			×	×	×	×	×	×	×		×	×
55	Lucius lucius								×	×							×	
56	Lucius masquinongy							×										
57	Anguilla chrysypa				×													
58	Labidesthes sicculus	×	×	×	×	×	×	×		×		×	×	×				
59	Aphredoderus sayanus																	
60	Pomoxis sparoides	×			×	×				×		×	×	×				×
61	Ambloplites rupestris	×	×	×	×	×	×	×	×	×	×							×
62	Chænobryttus gulosus											×	×	×		×		×
63	Lepomis cyanellus	×	×	×	×	×			×		×				×			×
64	Lepomis pallidus				×	×		×		×		×	×	×		×	×	×
65	Lepomis megalotis	×		×		×												×
66	Lepomis gibbosus					×	×	×	×	×		×	×	×			×	×
67	Micropterus dolomieu	×	×	×	×	×	×	×		×	×		×	×				×
68	Micropterus salmoides	×		×	×	×	×	×				×	×	×	×	×	×	×
69	Etheostoma pellucidum	×	×	×	×	×				×	×		×	×				
70	Etheostoma nigrum	×	×	×	×	×	×	×	×	×	×	×	×	×	×			×
71	Etheostoma blennioides	×	×		×	×	×		×	×	×		×	×				×
72	Etheostoma copelandi							×										
73	Etheostoma caprodes	×	×	×	×	×	×	×			×							
74	Etheostoma aspro	×	×	×	×	×			×	×	×		×	×	×			×
75	Etheostoma evides	×				×					×							
76	Etheostoma flabellare								×					×				×
77	Etheostoma cœruleum												×	×	×			×
78	Etheostoma cœruleum spectabile																	
79	Etheostoma jessiæ																	
80	Etheostoma eos											×				×		
81	Etheostoma microperca											×						
82	Perca flavescens					×	×	×				×	×				×	
83	Stizostedion vitreum					×		×										
84	Stizostedion canadense					×	×	×										
85	Roccus chrysops					×	×	×										
86	Aplodinotus grunniens				×	×	×	×										
87	Cottus bairdi									×					×			×

OF FISHES IN THE MAUMEE BASIN—Continued.

	St. Marys River.							Tiffin River.				Auglaize River.				Sugar Creek.			Blanchard River.						
Mill Creek.	St. Marys.	Rockford.	Decatur.	Fort Wayne.	Gordon Creek.	Lost Creek (Cecil).	Devils Lake.	Manitou Beach.	Hudson.	West Unity.	Brunersburg.	Wapakoneta.	Cloverdale.	Oakwood.	Defiance.	Lima.	Cloverdale.	Lost Creek (Lima).	Findlay.	Ottawa.	Cloverdale.	Hoaglin Creek.	Beaver Creek.	Lake Erie.	Number.
																								×	49
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	×	×	×							×	×	×	×	×	×		×			×		×			52
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	×	×	×							×	×											×			60
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×	×						×	×	×	×					×	×						×			64
	×	×	×	×		×	×	×		×	×	×	×		×	×	×		×	×					65
	×	×					×	×	×	×															66
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	×			×			×	×	×	×													×		68
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	×						×	×																×	82
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																									85
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																									87

21.—A STATISTICAL REPORT ON THE FISHERIES OF THE MIDDLE ATLANTIC STATES.

INTRODUCTORY NOTE.

The following report relating to the fisheries of the Middle Atlantic States is the last of a series of papers on the economic fisheries of the different geographical coast sections, emanating from the Division of Statistics and Methods of the Fisheries of this Commission. The regions previously covered by printed reports were the New England States, the Pacific States, the Gulf States, and the South Atlantic States, in the order named.

As was the case with the previous similar reports, the present article is based entirely on original field inquiries carried on by agents of the Commission. The investigations were conducted during parts of the fiscal years 1891, 1892, and 1893, and the statistics and other information obtained relate to the calendar years 1889, 1890, and 1891, and, in part, to 1892. The canvass of New York was assigned to Messrs. H. M. Smith, E. E. Race, and W. A. Wilcox. The fisheries of New Jersey were covered by Messrs. H. M. Smith, Ansley Hall, and E. E. Race. Pennsylvania was visited by Messrs. C. H. Stevenson and E. E. Race. The waters of Delaware, tributary to Chesapeake Bay, were canvassed by Mr. Race; the remainder of the State by Mr. Stevenson. The agents reporting on Maryland and Virginia were Messrs. W. A. Wilcox, T. M. Cogswell, H. M. Smith, C. E. Ingersoll, C. H. Stevenson, Ansley Hall, and E. E. Race. The special sections of these States investigated by each agent will be found recorded in my annual reports for the fiscal years 1891, 1892, and 1893.

The commercial fisheries of these States are more important than those of any other section in the United States in the items of persons engaged in the industry and the value of products. The capital invested in the fisheries is, however, much less than in the New England States. The returns for the last year covered by the statistics show that 90,923 persons found employment in the different branches of the industry; $19,318,664 was the value of the vessels, boats, apparatus, and other property used, and $19,023,474 was the value of the products to the fishermen.

The special fisheries which in the Middle Atlantic region are noticeably important and surpass in value those of all other regions combined are the alewife, bluefish, sea bass, shad, Spanish mackerel, squeteague, striped bass, white perch, yellow perch, clam, crab, terrapin, and oyster. The oyster fishery alone is worth $12,400,000, or more than one-fourth the value of the entire fishing industry of the United States, and more than that of the combined fisheries of the New England States. Next to the oyster in prominence is the shad, with a value of $1,216,000.

The report has been prepared by Dr. Hugh M. Smith, assistant in charge of the division. In the elaboration and compilation of the field agents' returns he has been aided by Mr. Charles H. Stevenson, principal office assistant, Mr. S. L. Pritchard, and other members of the divisional force.

MARSHALL McDONALD,
U. S. Commissioner of Fish and Fisheries.

A STATISTICAL REPORT ON THE FISHERIES OF THE MIDDLE ATLANTIC STATES.

By HUGH M. SMITH, M. D.,

Assistant in charge Division of Statistics and Methods of the Fisheries, U. S. Fish Commission.

GENERAL CONSIDERATIONS.

Geographical features of the region.—The group of coast States embraced by the title of this paper consists of New York, New Jersey, Pennsylvania, Delaware, Maryland (including District of Columbia), and Virginia. The Middle Atlantic States are sometimes regarded as including only the four States first named, but from the standpoint of the commercial fisheries the inclusion of Maryland and Virginia with the others mentioned and their exclusion from the group of States lying further to the south, are not only proper but are fully warranted by numerous considerations. While it is true that the fisheries of Maryland and Virginia have certain features that resemble those of North Carolina and other States of the South Atlantic seaboard, by far the strongest affiliations and resemblances are with the Middle Atlantic region.

These States have an area of 159,700 square miles, or about the same as Great Britain and Ireland, Denmark, Holland, and Belgium combined. The land area is 152,065 square miles and the water area 7,635 square miles. New York has the greatest land area, but Maryland, next to the smallest of the States, has relatively and actually the largest water area; this amounts to 2,350 square miles, or about 20 per cent of the total surface. The water areas subject to the jurisdiction of the several States are as follows:

States.	Square miles.
New York	1,550
New Jersey	360
Pennsylvania	230
Delaware	90
Maryland (including District of Columbia)	2,360
Virginia	2,325
Miscellaneous (unassigned waters in Delaware, lower New York, and Raritan bays)	720
Total	7,635

The length of the coast line of this section, following the indentations of the bays and including both sides of the rivers to the limits of commercial fishing, is approximately 5,400 miles. The extreme northern and southern points on the coast of these States, however, are only 340 miles apart in an air line.

This region had a population in 1890 more than one-fourth that of the entire country, namely, 15,798,055, while the counties having a frontage on the salt and fresh waters of the section and maintaining economic fisheries had a population of nearly one-eighth that of the United States, namely, 7,685,220.

This section is indented by three bays, which are among the largest on the coast of the United States and are extremely important in connection with the fisheries; these are New York Bay (with its several tributary bays), Delaware Bay, and Chesapeake Bay, which have a combined area of about 3,720 square miles. Into these bodies of water all the important rivers of the region drain; these are the Hudson, Delaware, Susquehanna, Potomac, Rappahannock, and James.

Scope and aims of the report.—The inquiry on which this report is based disclosed no very marked changes in the methods of conducting the fisheries of this region since the publication of the very full discussion of the subject in the Fisheries and Fishery Industries of the United States, relating primarily to the years 1879 and 1880. The chief purpose of this paper, therefore, is to show the condition and extent of the industry by means of detailed statistics. Noteworthy changes in methods of fishing, abundance of species, etc., will be referred to in the explanatory text for each State.

The paper is based on field investigations carried on during the fiscal years 1891, 1892, and 1893 by the agents of the division of statistics and methods of the fisheries of this Commission. The information has been obtained by the personal inquiries of the agents, and the statistics represent actual records of fishermen, fish dealers, and transportation agencies whenever such records were available. The statistical canvass was addressed principally to the calendar years 1889, 1890, and 1891, and the figures for New York, Maryland, and Virginia in the accompanying tables relate to those years; but owing to the lateness of the field inquiries in New Jersey, Delaware, and Pennsylvania it was possible to secure data for those States for the year 1892.*

The investigations of the river fisheries of this region were carried as far up the streams as commercial fishing existed. Thus the Hudson River was canvassed to Stillwater, N. Y.; the Delaware to Shawnee, N. J.; the Susquehanna to Columbia, Pa.; the Potomac to Washington, D. C.; the Rappahannock to Port Royal, Va.; the James to Richmond, Va.

Whenever available, records have been consulted in ascertaining the quantity and value of the catch, and in the case of a very large proportion of the professional fishing the figures presented may be regarded as being as nearly correct as it is possible to obtain. On the other hand, in the case of the semiprofessional fishing, especially that carried on in the upper courses of the rivers, it is the exception to find fishermen who keep a record of their catch, and in order to determine the approximate output of the various kinds of fishes taken it is often necessary to follow up very slight clues. A certain proportion of the fishermen know how much their fish sold for, and with this item as a basis the agents can, by judicious questioning, prepare a fairly accurate statement of the quantity of the yield, although the separation of the catch into species involves elements of uncertainty which must always render a fishery census of these minor fisheries unsatisfactory.

The statistical matter to be presented consists (1) of general condensed tables showing by States the extent of the fishing industry in the entire region, (2) of detailed tabulations for each State by counties, (3) of a series of statements giving the extent of some of the more important fisheries, and (4) of comparative statistics by States for 1880 and 1891.

* A paper on the statistics of the fisheries of the United States, embracing the region under discussion, was presented by the writer to the World's Fisheries Congress, convened at Chicago in October, 1893, and was published in the Bulletin of the U. S. Fish Commission for the same year. The figures therein contained, which were provisional, will be found to differ in some slight respects from those given in the present report, which is to be regarded as final.

In order to show the aggregate weight of the products of the fisheries, it has been necessary to reduce to the common unit of pounds certain articles which are not ordinarily sold on that basis, among these being oysters, clams, scallops, and crabs. In the case of mollusks, the quantities given in the tables represent the weights of the edible parts of those animals; thus, with oysters, round clams, long clams, and scallops, the weight of the meat and liquor is taken into consideration, while with scallops only the "eye" or "heart" is shown. The weights assigned to a bushel of each of these shellfish are 7 pounds to oysters, 8 pounds to round clams, 10 pounds to long clams and mussels, and 4½ pounds to scallops. The common edible crab is regarded as having an average weight of one-third of a pound; the horseshoe or king crab is rated at 2 pounds.

Nature of the fisheries and fishery resources.—The Middle Atlantic States have the distinction of maintaining more valuable fisheries than are carried on in any other region of the United States. The fishing population is about as numerous as that in all the other coast and lake States combined. The number of vessel fishermen, of shore and boat fishermen, and of factory hands and other shore employés is larger than in any other geographical division.

The aggregate value of the investment in fishing property is less than in the New England States. This is largely due to the relatively expensive class of vessels employed in the latter region. In the items of seines, fyke nets, oystering apparatus, number of vessels, and number of boats, the Middle Atlantic States take first rank.

The value of the fisheries, which affords the best basis for determining the importance of the industry, is much greater in this region than in any other, being one and a half times that of the next prominent section, New England.

Among especially prominent features of these fisheries are the very large fleet of small vessels, chiefly schooner and sloop rigs, engaged in taking oysters; the extensive use of pound nets, fyke nets, gill nets, and seines in the bays and rivers; the numerous small boats employed for oysters and clams; the employment of steam and sail vessels in the capture of menhaden, and the very valuable shore industries dependent on the oyster and menhaden fisheries.

Features of the fishing industry of the Middle Atlantic region which contrast very strongly with that of the geographical section adjoining on the north are the general unimportance of the food-fish industries carried on with vessels and the practical absence of any fishing on the high seas. Only in New York is the use of vessels for the capture of food-fish important, and only in New Jersey are the operations of the shore fishermen noticeably extensive on the ocean grounds beyond jurisdictional limits. It is estimated that fully 90 per cent of the value of the fishery products of this section is from waters within the control of the States.

The waters of this region are perhaps more remarkable for the great abundance of the important fishery objects there found than for an especially large variety of desirable fish and other animals, such as is present on the coasts of the Gulf and Pacific States. While some seventy fishes of recognized food value occur regularly on the ocean shores, in the bays, or in the rivers of the region, and while the number of invertebrate and other aquatic products is not small, the great prominence which the fishing industry of these States has attained may be said to depend on two products, namely, the shad and the oyster, which are here more abundant and valuable than in all the remainder of the country combined.

The following list embraces all the important food and bait fishes of this region, as well as some others that are of considerable value during certain years. The more acceptable common names are given, the local names employed in the different States are shown, and the scientific identifications are added for accuracy.

Common and scientific names of the important fishes of the Middle Atlantic States.

Common names.	Local names.	Scientific names.
Albacore; Little tunny	Albacore	Gymnosarda alletterata.
	Applecore, N. J.	
	Horse-mackerel, Va.	
Alewife; River herring	Alewife	Clupea æstivalis.
	Glut herring, Potomac River.	
	Herring.	
	Summer herring.	
Alewife; River herring	Alewife	Clupea pseudoharengus.
	Branch herring, Potomac River.	
	Herring.	
Bluefish	Bluefish	Pomatomus saltatrix.
	Greenfish, Md., Va.	
	Horse-mackerel, N. Y.	
	Mackerel, N. J.	
	Salt-water tailor, Md., Va.	
	Skipjack, Md.	
	Skip mackerel, N. Y.	
	Snap mackerel, N. J.	
	Snapping mackerel, N. J.	
	Snapper, N. J.	
	Tailor, Md., Va.	
	Whitefish, N. Y.	
Bonito	Bone-eater, N. J.	Sarda sarda.
	Bonejack, N. J.	
	Bonito.	
	Skipjack.	
Brier ray; Prickly ray	Bob-tailed skate, N. J.	Raia eglanteria.
	Prickly skate, Md.	
Butter-fish	Butter-fish	Stromateus paru.
	Dollar-fish, N. J.	
	Harvest-fish, N. J., Md., Va.	
	Starfish, Va.	
Carp	Carp	Cyprinus carpio.
Catfish, channel	Black cat	Ameiurus albidus.
	Channel cat.	
	Schuylkill cat, Pa.	
	White cat.	
Catfish, common; Bullhead	Bullhead	Ameiurus nebulosus.
	Mud cat.	
	Yellow cat.	
Cero; Kingfish	Cero	Scomberomorus regalis.
	Kingfish.	
	Searer, N. J.	
	Searing, N. J.	
	Sier, N. J.	
Cobia; Crab-eater	Bonito, Chesapeake Bay	Elacate canada.
	Coalfish, Chesapeake Bay.	
Cod	Cod	Gadus morrhua.
Conger eel	Conger eel	Leptocephalus conger.
	Sea eel.	
Croaker	Croaker	Micropogon undulatus.
	Crocus, Chesapeake Bay.	
	Grumbler, Potomac River.	
Cunner; Chogset	Bengall, N. J.	Ctenolabrus adspersus.
	Burgall, N. Y.	
	Gall, N. J.	
Drum, black	Banded drum (young)	Pogonias cromis.
	Black drum.	
Drum, red	Drum	Sciæna ocellata.
	Red drum.	
Eel	Eel	Anguilla chrysypa.
Flounder, summer; Plaice	Chicken halibut, Chesapeake Bay.	Paralichthys dentatus.
	Flatfish.	
	Flounder.	
	Fluke, N. J.	
	Plaice.	
	Splaice, N. J.	
Flounder, winter	Flatfish	Pseudopleuronectes americanus.
	Flounder.	
	Winter flounder.	
Haddock	Haddock	Melanogrammus æglifinus.
Hake	Hake	Phycis chuss, P. tenuis.
	Ling, N. J.	
Halibut	Halibut	Hippoglossus hippoglossus.

Common and scientific names of the important fishes of the Middle Atlantic States—Continued.

Common names.	Local names.	Scientific names.
Hickory shad	Autumnal herring, Md. Fresh-water tailor, Potomac River. Greenback, N. Y Herring, N. J. Hick, Chesapeake Bay. Hickory jack. Hickory shad, Chesapeake Bay. Shadine, N. J. Tailor shad, Potomac River.	Clupea mediocris.
Kingfish	Barb, N. J. Black mullet, Chesapeake Bay. Hake, N. J., Del. Kingfish. Sea mullet, Va.	Menticirrus nebulosus.
Mackerel	Boston mackerel, N. J. Mackerel.	Scomber scombrus.
Menhaden	Alewife, Del., Md., Va. Bay alewife, Chesapeake Bay. Bugfish, Va. Bughead, Va. Bug shad, Va. Bunker, N. J., Chesapeake Bay. Chebaug, N. J. Greentail. Marshbanker, N. J. Menhaden. Mossbunker, N. Y. Oldwife, Va. Pilcher, Va.	Brevoortia tyrannus.
Moonfish	Angel-fish Moonfish. Porgee.	Chætodipterus faber.
Mullet, striped	Fatback, Va Jumping mullet, Va. Mullet. Striped mullet.	Mugil cephalus.
Pigfish	Grunt, Chesapeake Bay Hogfish, Chesapeake Bay. Speckled redmouth, Chesapeake Bay.	Pomadasys fulvomaculatus.
Pike; Chain pickerel	Pickerel Pike.	Lucius reticulatus.
Pike; Banded pickerel	Pickerel Pike. Brook pickerel, Hudson River. Ditch pike, Delaware River.	Lucius americanus.
Pollock	Pollock	Pollachius virens.
Pompano	Pompano Sunfish, Va.	Trachinotus carolinus.
Redhorse	Large-scaled sucker Mullet. Mullet sucker, Potomac River. Redhorse. Red mullet, Potomac River.	Moxostoma macrolepidotum.
Salmon	Salmon	Salmo salar.
Scup	Fair maid, Va. Porgy, N. Y., N. J. Sea porgy, N. J.	Stenotomus chrysops.
Sea bass	Black bass, Va Blackfish. Black will, Chesapeake Bay. Black perch, Md. Black nell, Md. Sea bass.	Serranus atrarius.
Sea-robin	Flying-fish, N. J., Va. Pigfish, N. J. Sea robin.	Prionotus strigatus, P. palmipes.
Shad	Shad	Clupea sapidissima.
Sheepshead	Sheepshead	Archosargus probatocephalus.
Skate, smooth; Barn-door skate	Smooth skate	Raia lævis.
Smelt	Smelt	Osmerus mordax.
Spanish mackerel	Bay mackerel, Chesapeake Bay. Spaniard, N. J. Spanish mackerel.	Scomberomorus maculatus.
Spot	Cape May goody, N. J. Croaker, Md. Crocus, Md. Goody, N. J. Lafayette-fish, N. Y. Porgy, N. J. Roach, Va. Spot.	Leiostomus xanthurus.

Common and scientific names of the important fishes of the Middle Atlantic States—Continued.

Common names.	Local names.	Scientific names.
Squeteague, spotted	Salmon trout, Va. Spotted sea trout, Chesapeake Bay. Trout. White trout, Va.	Cynoscion nebulosus.
Squeteague; Weakfish	Bluefish, N. Y., N. J., Del., Md., Va. Chickwit, N. Y. Gray trout, Va. Salt-water trout, Chesapeake Bay. Sea trout, Chesapeake Bay. Squeteague. Trout, Chesapeake Bay. Weakfish	Cynoscion regalis.
Striped bass	Rock Rockfish. Striped bass.	Roccus lineatus.
Sturgeon	Mamoose, Delaware River Moose (young), N. J. Sturgeon.	Acipenser sturio oxyrhynchus.
Sucker, black	Black sucker, Md., Va. Mud sucker, Md. Mullet. Sucker.	Catostomus nigricans.
Sucker, brook	Fine-scaled sucker Mud sucker, Md. Sucker.	Catostomus commersoni.
Tautog	Blackfish Chub, N. J., Va. Moll, Va. Salt-water chub, Chesapeake Bay. Smooth blackfish, N. J. Sea-tog, N. J. Tautog. Will George, Va.	Tautoga onitis.
Tomcod	Frostfish Tomcod	Microgadus tomcodus.
White perch	Black perch, N. J Perch. White perch. Yellow perch, N. J.	Morone americana.
Yellow perch	Perch Yellow ned, Md. Yellow perch.	Perca flavescens.
Yellow-tail	King William perch, Va. Silver perch, N. J. White perch, N. J., Md.	Bairdiella chrysura.

The principal molluscan resources of this region are the oyster (*Ostrea virginica*), the quahog, round clam or hard clam (*Venus mercenaria*), the soft clam or long clam (*Mya arenaria*), the mussel (*Mytilus edulis*), the scallop (*Pecten irradians*), the "jingle" (*Anomia ephippium*), the "quarter deck" (*Crepidula fornicata*), and the squid (*Loligo pealei*). The scallop and two shells employed in oyster planting, the "jingle" and "quarter deck," are taken only in New York, but the other mollusks are found in all the other States having frontage on salt water, although all except the oyster are somewhat more abundant in the more northern States of the section.

The economic crustaceans of this region are the lobster (*Astacus americanus*), the king crab or horseshoe crab (*Limulus polyphemus*), the common blue crab (*Callinectes hastatus*), the shrimp (*Crangon vulgaris*), and crawfishes (*Cambarus*). The lobster is restricted to the coast waters of the States north of Maryland, and the crawfishes are taken only in Maryland and Virginia, but the other crustaceans named are generally distributed throughout the Middle Atlantic region.

The reptilian resources of these States include the diamond-back terrapin (*Malaclemmys palustris*), the slider or red-bellied terrapin (*Pseudemys rugosa*), the bullfrog (*Rana catesbiana*), and several sea turtles.

CONDENSED STATISTICS.

The statistical aspect of the fisheries of the Middle Atlantic States is shown in a general way in the following series of tables. These tabulations make it possible to ascertain at a glance the relative importance of the fishing industry in each State as compared with the entire region and with each of the other States, and are preliminary to the very detailed statistics which are afterwards presented. The general tables which are given pertain to the persons engaged; the apparatus, vessels, boats, etc., employed, and the quantity and value of the catch, viewed from several standpoints.

It appears that of the 90,923 persons employed in the fishing industry of this region in 1891, 15,213 were vessel fishermen, 54,906 were shore and boat fishermen, 2,500 were carriers of fishery products, and 18,304 were shore help, factory hands, etc. Considerably more than two-fifths of the fishery employés, viz, 39,944, were in Maryland and nearly one-fourth, namely, 23,591, were in Virginia. The order of rank of the other States was New York, New Jersey, Pennsylvania, and Delaware.

Persons engaged in the fisheries of the Middle Atlantic States.

States.	Vessel fishermen.	Shore fishermen.	Transporters.	Shoresmen.	Total.
New York	2,250	7,858	96	2,042	12,246
New Jersey	2,017	7,889	201	532	10,639
Pennsylvania	348	1,631	5	289	2,273
Delaware	103	1,653	43	431	2,230
Maryland (including District of Columbia)	6,892	19,867	1,450	11,735	39,944
Virginia	3,603	16,008	705	3,275	23,591
Total	15,213	54,906	2,500	18,304	90,923

The money invested in this industry was $19,318,664, of which Maryland is credited with $7,466,718, New York with $5,283,200, Virginia with $2,948,659, New Jersey with $2,467,865, Pennsylvania with $944,140, and Delaware with $208,082. The factors entering most conspicuously into this large amount are vessels, boats, shore property, and working capital.

No less than 3,169 vessels of over 5 tons register were engaged in the actual taking of fishery products, and 758 others were employed exclusively in transporting the catch. This fleet was valued, with the outfits, at $4,701,818, and its tonnage was 68,714. Over 1,625 of the vessels were in Maryland and about 945 in Virginia, the other four States having 1,356.

Boats to the number of 32,824, valued at $1,889,138, exclusive of those constituting a part of the vessels' equipment, were used. Of these 9,825 were in Maryland, 9,247 in Virginia, 6,227 in New York, 5,742 in New Jersey, and 1,783 in Pennsylvania and Delaware.

The various kinds of property used on shore in connection with the business, such as factories, fish-houses, reels, etc., had a value of $5,863,606. Maryland, owing chiefly to its extensive and numerous oyster-packing establishments, had the largest share in this amount, $2,446,327 being thus credited; New York followed, with $1,794,969, and Virginia with $717,787. The working or cash capital required to properly conduct the fishing industry was $5,140,955. This is a somewhat uncertain though very important item, which may be viewed in several different ways, and varies with the method of consideration. As here regarded, it is the amount of ready money which must be kept by fishery operators, wholesale purchasing agents, and factory owners in order to meet the current demands for fish, wages, materials, etc.

This element is largest in Maryland and New York, and smallest in Virginia, of the four States having a noticeably large fishery investment.

Foremost in value among the appliances used in the capture of fishery products are the gill nets; 30,158 of these were employed in 1891, with a value of $419,722, these figures including a few trammel nets, which are structurally gill nets. Maryland leads in the number of gill nets, but New Jersey takes precedence in the value of such nets; and while Virginia leads New York in the number of nets, the latter State surpasses in value.

The dredges, scrapes, rakes, tongs, and forks used mostly in the extensive molluscan fisheries together had a value of $474,304, a sum representing 51,578 such appliances. In the vessel fisheries, 8,875, valued at $235,071, were employed; and in the boat fisheries 42,703, valued at $239,233. The investment of Maryland in these items was $198,920.

Pound nets, trap nets, and weirs constitute an important class of fishing appliances, which is represented in every State except Pennsylvania and is prominent in New York, New Jersey, Maryland, and Virginia. The number of such nets was 2,414, having a value of $365,783, of which 1,005, worth $71,778, were in Maryland, and 941, worth $166,990, were in Virginia. In New York, 90 traps, valued at $32,350, were operated from small vessels.

Haul and purse seines, to the number of 1,808, were fished in this region, the former being well distributed among all the States, while the latter are chiefly in New York and Virginia. The value of all seines was $278,230.

The number and value of other important kinds of apparatus used in these States were as follows: Fyke and bag nets, 21,736, $125,565; pots, 27,214, $27,722; lines, $23,310; miscellaneous appliances, including spears, dip nets, etc., $8,511.

Vessels, boats, apparatus, shore property, and cash capital employed in fisheries of the Middle Atlantic States.

Designation.	New York.		New Jersey.		Pennsylvania.	
	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	618	$773,442	524	$541,520	47	$84,900
Tonnage	8,496		7,883		1,194	
Outfit		168,388		122,433		19,410
Vessels transporting	41	44,100	83	108,150	2	2,875
Tonnage	796		1,437		26	
Outfit		5,710		13,255		110
Boats	6,227	373,670	5,742	412,373	837	30,652
Apparatus—vessel fisheries:						
Seines	69	39,850	12	6,100		
Trap nets	90	32,350				
Lines, hand and trawl		8,870		370		206
Eel pots	90	248	40	20		
Lobster pots	490	1,137	230	225		
Dredges, rakes, and tongs	1,860	43,322	2,032	44,251	143	5,035
Apparatus—shore fisheries:						
Seines	258	35,790	360	31,922	151	19,405
Gill nets and trammel nets	6,402	88,450	3,983	129,832	209	21,450
Pound nets and weirs	173	38,990	185	55,370		
Fyke nets and bag nets	6,246	55,465	1,692	18,881	2,534	5,264
Lines		2,875		4,808		427
Eel pots	13,568	13,674	3,760	3,901		
Lobster pots	1,750	2,332	725	1,193		
Spears	3,489	3,728	216	404		
Dredges and scrapes	4,872	43,200	1,184	8,334		
Tongs and forks	6,987	33,390	3,474	15,625		
Minor apparatus		250		487		494
Shore and accessory property		1,794,969		409,561		450,162
Cash capital		1,679,000		538,850		303,750
Total		5,283,200		2,467,865		944,140

Vessels, boats, apparatus, shore property, and cash capital employed in fisheries, etc.—Continued.

Designation.	Delaware.		Maryland.*		Virginia.		Total.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	25	$21, 525	1, 225	$876, 705	730	$498, 440	3, 169	$2, 796, 532
Tonnage	304		21, 033		9, 087		47, 997	
Outfit		3, 390		331, 709		169, 923		815, 263
Vessels transporting	16	13, 250	402	570, 150	214	241, 695	758	980, 220
Tonnage	224		13, 150		5, 084		20, 717	
Outfit		1, 975		59, 685		29, 068		109, 803
Boats	946	29, 233	9, 825	579, 488	9, 247	463, 722	32, 824	1, 889, 138
Apparatus—vessel fisheries:								
Seines			15	8, 450	41	25, 650	137	80, 050
Trap nets							90	32, 350
Lines, hand and trawl						30		9, 476
Eel pots							130	268
Lobster pots							720	1, 362
Dredges, rakes, and tongs	110	2, 110	2, 913	115, 661	1, 827	24, 692	8, 875	235, 071
Apparatus—shore fisheries:								
Seines	203	10, 263	521	68, 330	178	32, 470	1, 671	198, 180
Gill nets and trammel nets	1. 586	33, 946	11, 999	100, 014	5, 979	46, 030	30, 158	419, 722
Pound nets and weirs	20	305	1, 005	71, 778	941	166, 990	2, 324	333, 433
Fyke nets and bag nets	567	1, 261	10, 358	38, 924	339	5. 770	21, 736	125, 565
Lines		20		2, 272		3, 432		13, 834
Eel pots	1, 775	784	4, 636	4, 013	110	95	23, 849	22, 467
Lobster pots	40	100					2, 515	3, 625
Spears	170	85			15	10	3, 890	4, 227
Dredges and scrapes			2, 068	10, 509	198	4, 640	8, 322	66, 683
Tongs and forks	243	522	12, 921	72, 750	10, 756	50, 263	34, 381	172, 550
Minor apparatus		113		2, 498		442		4, 284
Shore and accessory property		44, 800		2, 446, 327		717, 787		5, 863, 606
Cash capital		44, 400		2, 107, 455		467, 500		5, 140, 955
Total		208, 082		7, 466, 718		2, 948, 659		19, 318, 664

* Includes District of Columbia.

The yield of the fisheries of this region was 590,454,369 pounds, having a first value of $19,023,474. The quantity given includes only the net weights of shellfish. Owing to the large catch of a comparatively cheap fish (menhaden) in New York and Virginia, the quantity of products there taken was considerably larger than in Maryland, the fisheries of which were far more valuable. The table shows that the fisheries of the latter State were worth $6,460,759, those of New York $4,817,369, those of Virginia $3,647,845, those of New Jersey $3,520,057, those of Pennsylvania $322,021, and those of Delaware $255,423.

Products of the fisheries of the Middle Atlantic States.

Species.	New York.		New Jersey.		Pennsylvania.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives	2, 194, 560	$23, 526	2, 066, 820	$14, 260	2, 331, 775	$13, 449
Black bass			9, 250	1, 166	22, 885	2, 368
Bluefish	5, 506, 575	237, 010	7, 227, 926	264, 163		
Bonito	1, 750	150	150, 633	9, 857		
Butter-fish	837, 246	12, 988	230, 802	6, 582		
Carp			2, 000	160	3, 800	199
Catfish	117, 180	5, 144	133, 824	8, 265	132, 468	6, 223
Cod	2, 277, 458	89, 921	841, 011	26, 001		
Drum			124, 240	980		
Eels	1, 616, 213	97, 999	623, 280	38, 594	40, 950	2, 174
Flounders	1, 561, 696	45, 231	987, 895	33, 620		
Frostfish or tomcod	278, 400	10, 468	1, 400	42		
Haddock	147, 730	3, 890	17, 940	675		
Kingfish	157, 541	10, 792	33, 697	2, 298		
Mackerel			25, 117	2, 316		
Menhaden	104, 860, 114	295, 605	20. 670, 542	56, 974		
Mullet	160, 060	7, 878	88, 350	4, 902		
Perch, white	41, 209	2, 637	193, 724	13, 539	6, 020	341
Perch, yellow	46, 916	3, 692	500, 238	27, 219	12, 625	674
Pike	8, 215	740	19, 485	1, 904	4, 975	697
Scup	350, 858	7, 016	25, 682	855		
Sea bass	679, 180	35, 915	3, 731, 538	147, 693	947, 500	33, 805
Shad	3, 044, 956	161, 209	10, 225, 455	443, 438	2, 692, 864	128, 274
Sheepshead	19, 523	3, 500	26, 290	4, 013		
Skates	101, 897	2, 022	7, 050	353		
Spanish mackerel	74, 836	7, 255	78, 391	12, 620		

Products of the fisheries of the Middle Atlantic States—Continued.

Species.	New York.		New Jersey.		Pennsylvania	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Spots and croakers	17, 501	$700	106, 680	$4, 521		
Squeteague	2, 852, 653	111, 301	6, 002, 563	201, 515		
Striped bass	205, 449	21, 389	298. 164	43, 296	24, 615	$2, 406
Sturgeon	30, 261	929	452, 630	10, 619	52. 700	640
Suckers	25, 378	1, 545	56, 680	4, 008	42. 550	2, 115
Tautog	171, 172	7, 618	99, 437	3, 894		
Other fish	236, 991	8, 028	167, 320	3. 684	84, 230	4, 236
Refuse fish	1, 118, 913	2, 733				
Oysters	18, 277. 434	2, 748, 509	16, 114, 567	1, 639, 648	1, 183, 700	124, 420
Soft clams or long clams	1, 505, 500	105, 891	827, 000	47, 700		
Quahogs or hard clams	4, 524, 520	650, 621	3, 454, 024	371, 933		
Scallops	313, 042	48. 340				
Mussels	21, 000	900	6, 000	200		
Squid	40, 836	1, 633				
Shells	16, 766, 100	15, 950				
Crabs, hard	435, 566	7, 589	230, 111	9, 499		
Crabs, soft	93, 500	3, 450	289, 500	35, 380		
Lobsters	165, 093	15, 655	165, 664	12, 463		
Shrimp			1, 200	600		
King crabs			2, 798, 980	7. 534		
Terrapins			3, 280	1. 074		
Total	170, 885, 022	4. 817, 369	79, 116, 380	3, 520, 057	7, 583, 657	322, 021

Species.	Delaware.		Maryland.*		Virginia.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives	863, 760	$12, 412	17, 418, 850	$131, 245	11, 013, 485	$93. 905	35, 889, 250	$288, 797
Black bass					7, 000	430	39, 135	3, 964
Bluefish			516, 364	22, 761	1, 842, 264	67, 545	15, 093, 129	591, 479
Bonito							152, 383	10, 007
Butter-fish			31, 955	785	120, 000	2, 900	1, 220, 003	23, 255
Carp			27, 628	780	13, 370	576	46, 798	1, 715
Catfish	73, 800	4, 074	1, 296, 752	45, 502	935, 244	28, 487	2, 689, 268	97, 695
Cobia or crab-eater					195, 250	4, 948	195, 250	4, 948
Cod							3, 118, 469	115, 922
Drum	30, 000	380			179, 502	4, 011	333, 742	5, 371
Eels	223, 500	8, 967	792, 044	32, 919	71, 619	2. 907	3, 367, 606	183, 560
Flounders	5, 000	168	33, 443	1, 008	127, 295	4, 109	2, 715, 329	84, 136
Frostfish or tomcod							279, 800	10, 510
Haddock							165, 670	4, 565
Kingfish	960	48			149, 565	7, 097	341, 763	20, 235
Mackerel							25. 117	2, 316
Menhaden	67, 000	420	30, 952, 120	65, 307	105. 980, 334	197, 523	262, 530, 110	615, 829
Mullet	38, 900	1, 125	101, 540	2. 974	110, 700	2, 736	499, 550	19, 615
Perch, white	212, 945	14, 113	1, 109, 273	57, 038	299, 813	12, 010	1, 862, 984	99, 678
Perch, yellow	42, 910	2, 026	1, 385, 352	48, 040	169, 020	6, 799	2, 157, 061	88, 450
Pike	24, 950	1, 548	563, 264	35, 261	12, 415	795	633, 304	40, 945
Pompano					93, 700	9, 520	93, 700	9. 520
Scup							376, 540	7, 871
Sea bass			113. 370	4, 544	66, 310	2, 270	5, 537, 898	224, 227
Shad	1, 500, 196	64, 699	6, 224, 873	211, 575	6, 498, 242	207, 394	30, 186, 586	1, 216, 589
Sheepshead			3, 185	396	23, 871	1, 344	72, 869	9, 253
Skates							108, 947	2, 375
Spanish mackerel			44, 837	5, 369	739, 910	50, 756	937, 974	76, 000
Spots and croakers	42, 460	2, 280	273, 283	12, 119	1, 725, 847	62, 122	2, 165, 771	81, 742
Squeteague	1, 164, 730	17, 524	750, 465	25. 902	3, 929, 899	124, 645	14, 700, 310	480, 887
Striped bass	94, 910	12, 758	1. 264, 693	97, 770	483, 436	42, 127	2. 371, 267	219, 746
Sturgeon	1, 304, 800	30. 448	72. 445	2. 343	723, 646	21, 364	2, 636, 482	66, 343
Suckers	11. 050	501	285, 238	7, 533	116, 364	3, 153	537, 260	18, 855
Tautog	8, 000	320					278, 609	11, 832
Other fish	4, 380	164	438, 683	14, 561	1, 514, 657	38, 675	2, 446, 261	69, 348
Refuse fish							1, 118. 913	2, 733
Oysters	1. 097, 040	70, 134	69, 615, 406	5, 295, 866	43, 134. 602	2, 524, 348	149, 422, 749	12, 402. 925
Soft clams or long clams							2, 332, 500	153. 591
Quahogs or hard clams	21, 920	2, 094	147, 760	8, 226	559, 278	36, 030	8. 707, 502	1, 668, 904
Scallops							313, 042	48, 340
Mussels							27, 000	1, 100
Squid							40, 836	1, 633
Shells							16, 766, 100	15, 950
Crabs, hard			2, 776. 898	37, 460	2, 308, 071	32, 683	5, 750, 646	87, 231
Crabs, soft	86. 250	4, 713	4, 828, 872	266, 256	585, 956	29, 379	5, 884, 078	339, 178
Lobsters	8, 200	410					338, 957	28, 528
Crawfish			7, 350	695	833	75	8, 183	770
Shrimp			8, 044	3, 960			9, 244	4, 560
King crabs	740, 000	647					3, 538, 980	8, 181
Frogs					21, 000	2, 754	21, 000	2, 754
Terrapins	11, 988	2, 190	89, 780	22, 333	52, 215	18, 494	157, 263	44, 091
Turtles	18. 000	1, 260	4. 060	231	189, 121	3, 934	211, 181	5, 425
Total	7, 697. 649	255, 423	141, 177, 827	6, 460, 759	183, 993, 834	3, 647, 845	590, 454, 369	19, 023, 474

* Includes District of Columbia.

The products of the fisheries of this region may be classified as general food-fish, mollusks, crustaceans, reptiles, and menhaden utilized for oil and guano. The extent of the fisheries for each of these classes is given in the following table, which shows that the yield of the molluscan fisheries was $13,692,443; the general food-fish fisheries, $4,194,484; the menhaden fishery, $615,829; the crustacean fisheries, $468,448; and the reptilian fisheries, $52,270.

The mollusks are the most important products in all the States except Pennsylvania and Delaware, in which food-fish are most prominent. Maryland holds the first place in the value of mollusks and crustaceans, New Jersey leads in the value of its fisheries for fish proper, New York takes precedence in the value of its menhaden fishery, and Virginia occupies the first rank for reptilian fisheries.

Classification of the products of the fisheries of the Middle Atlantic States.

States.	General food-fish fisheries.		Oyster and other molluscan fisheries.		Crustacean fisheries.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
New York	23, 882, 317	$923, 226	41, 448, 432	$3, 571, 844	694, 159	$26, 694
New Jersey	34, 555, 512	1, 337, 052	20, 401, 591	2, 059, 481	3, 485, 455	65, 476
Pennsylvania	6, 399, 957	197, 601	1, 183, 700	124, 420	....	....
Delaware	5, 647, 251	173, 555	1, 118, 960	72, 228	834, 450	5, 770
Maryland	32, 747, 537	760, 425	69, 763, 166	5, 304, 092	7, 621, 164	308, 371
Virginia	31, 162, 424	802, 625	43, 693, 880	2, 560, 378	2, 894, 860	62, 137
Total	134, 394, 998	4, 194, 484	177, 609, 729	13, 692, 443	15, 530, 088	468, 448

States.	Reptilian fisheries.		Menhaden fishery.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
New York	....	....	104, 860, 114	$295, 605	170, 885, 022	$4, 817, 369
New Jersey	3, 280	$1, 074	20, 670, 542	56, 974	79, 116, 380	3, 520, 057
Pennsylvania	....	....	....	....	7, 583, 657	322, 021
Delaware	29, 988	3, 450	67, 000	420	7, 697, 649	255, 423
Maryland	93, 840	22, 564	30, 952, 120	65, 307	141, 177, 827	6, 460, 759
Virginia	262, 336	25, 182	105, 980, 334	197, 523	183, 993, 834	3, 647, 845
Total	389, 444	52, 270	262, 530, 110	615, 829	590, 454, 369	19, 023, 474

Considerable general interest attaches to the relative quantities of fishery products destroyed or sacrificed by the different kinds of apparatus employed. In the following table the quantity and value of the catch with each principal class of appliances are shown, and in a supplementary table the facts disclosed by the first table are reduced to the basis of percentage. In every State, except Delaware, dredges, tongs, and other similar apparatus employed in taking shellfish are the most important means of capture. Of the remaining forms of apparatus, lines are the most prominent in New Jersey; seines in New York, Pennsylvania, and Maryland; gill nets in Delaware, and pound nets in Virginia.

Considering the entire region, the order of rank based on value of catch is (1) dredges, tongs, etc., (2) seines, (3) gill nets, (4) lines, (5) pound nets, trap nets, and weirs, (6) miscellaneous apparatus, (7) fyke nets, and (8) pots. The figures for seines, gill nets, pound nets, fyke nets, pots, and lines refer only to fish proper, while the crustaceans and other products taken with these appliances appear under miscellaneous apparatus.

Quantity and value of products taken with each kind of apparatus employed in the Middle Atlantic States.

Apparatus.	New York.		New Jersey.		Pennsylvania.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines	103, 188, 374	$445, 951	21, 124, 166	$223, 077	3, 817, 247	$100, 208
Gill nets	4, 953, 280	222, 014	10, 586, 442	435, 908	1, 370, 550	47, 953
Pound nets and weirs	9, 909, 828	123, 834	7, 992, 260	125, 100	....	....
Fyke nets	2, 382, 882	48, 903	786, 210	37, 329	146, 695	6, 659
Pots	975, 031	60, 001	285, 700	16, 350	....	....
Lines	6, 656. 605	276, 979	14, 254, 026	543, 687	1, 033, 310	40, 567
Dredges, tongs, and rakes	41, 407, 596	3, 570, 211	20, 401, 591	2, 059, 481	1, 183, 700	124, 420
Miscellaneous apparatus	1, 411, 426	69. 476	3, 685, 985	79, 125	32, 155	2, 214
Total	170, 885, 022	4, 817, 369	79, 116, 380	3, 520, 057	7, 583, 657	322, 021

Apparatus.	Delaware.		Maryland.		Virginia.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines	2, 029, 244	$48, 156	43, 128, 398	$325, 976	104, 872, 062	$284, 422	278, 159, 491	$1, 427, 790
Gill nets	3, 343, 425	111, 451	8, 571, 287	217, 088	4, 857, 214	124, 617	33, 682, 198	1, 159, 031
Pound nets and weirs	27, 891	1, 037	8, 875, 190	165, 423	23, 851, 951	472, 689	50, 657, 120	888, 083
Fyke nets	45, 091	2, 591	1, 546, 864	60, 549	325, 861	12, 845	5, 233, 603	168, 876
Pots	97, 300	4, 070	389, 740	16, 030	4, 000	325	1, 751, 771	96, 776
Lines	41, 700	1, 532	970, 135	35, 271	3, 227, 845	105, 060	26, 183, 621	1, 003, 096
Dredges, tongs, and rakes	1, 118, 960	72, 228	69, 763, 166	5, 304, 092	43, 693, 880	2, 560, 378	177, 568, 893	13, 690, 810
Miscellaneous apparatus	994, 038	14, 358	7, 933, 047	336, 330	3, 161, 021	87, 509	17, 217, 672	589, 012
Total	7, 697, 649	255, 423	141, 177, 827	6, 460, 759	183. 993, 834	3, 647, 845	590, 454, 369	19, 023, 474

From the percentage table it appears that 30.07 per cent of the quantity and 71.97 per cent of the value of the fishery products of this section were obtained with dredges, tongs, rakes, etc., these figures representing essentially the extent of the molluscan fisheries. The largest quantity of fish, amounting to 47.11 per cent of the entire yield, was taken with seines. The relative value of the seine catch was also greater than that with any other apparatus except the dredges, tongs, etc., being 7.50. Pound nets, trap nets, and weirs took 8.58 per cent of the aggregate production, ranking third in this respect, but the value of the stock was only 4.67 per cent, being less than that with gill nets and lines. Gill nets yielded 5.70 per cent of the quantity and 6.09 per cent of the value of the catch, followed by lines with 4.43 per cent of the quantity and 5.27 per cent of the value. The relative importance of the other forms of apparatus is insignificant.

Table showing the relative quantity and value of the products taken with each kind of apparatus in each State and the entire region as compared with the total quantity and value of the catch of each State and the entire region.

Apparatus.	New York.		New Jersey.		Pennsylvania.		Delaware.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Dredges, tongs, etc	24. 23	74. 11	25. 79	58. 51	15. 61	38. 64	14. 54	28. 28
Seines	60. 38	9. 26	26. 70	6. 34	50. 34	31. 11	26. 36	18. 85
Gill nets	2. 90	4. 61	13. 38	12. 38	18. 07	14. 89	43. 43	43. 64
Pound nets, traps, etc	5. 80	2. 57	10. 10	3. 55	....	....	. 36	. 41
Lines	3. 90	5. 75	18. 02	15. 45	13. 63	12. 60	. 54	. 60
Fyke nets	1. 39	1. 02	. 99	1. 06	1. 93	2. 07	. 59	1. 01
Pots	. 57	1. 24	. 36	. 46	....	....	1. 26	1. 59
Miscellaneous	. 83	1. 44	4. 66	2. 25	. 42	. 69	12. 92	5. 62
Total	100. 00	100. 00	100. 00	100. 00	100. 00	100. 00	100. 00	100. 00

Table showing the relative quantity and value of the products taken with each kind of apparatus in each State and the entire region as compared with the total quantity and value of the catch of each State and the entire region—Continued.

Apparatus.	Maryland.		Virginia.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Dredges, tongs, etc	49.41	82.10	23.75	70.19	30.07	71.97
Seines	30.55	5.04	57.00	7.79	47.11	7.50
Gill nets	6.07	3.36	2.64	3.42	5.70	6.09
Pound nets, traps, etc	6.29	2.56	12.96	12.96	8.58	4.67
Lines	.69	.55	1.75	2.88	4.43	5.27
Fyke nets	1.10	.94	.18	.35	.89	.89
Pots	.27	.25	[.002]	.01	.30	.51
Miscellaneous	5.62	5.20	1.72	2.40	2.92	3.10
Total	100.00	100.00	100.00	100.00	100.00	100.00

The relative value of each important fishery product in each State as compared with the entire region is exhibited in the following table, which brings out some interesting points. Cod, eels, flounders, soft clams, and hard clams, among the more prominent products, are taken in largest quantities in New York; bluefish, sea bass, shad, and squeteague in New Jersey; sturgeon in Delaware; alewives, catfish, white perch, yellow perch, striped bass, crabs, and oysters in Maryland; menhaden, spots and croakers, and Spanish mackerel in Virginia. Of the species of which more than half the catch in the entire region is taken in a single State, are cod, flounders, soft clams, and hard clams in New York; sea bass in New Jersey; white perch, yellow perch, striped bass, and crabs in Maryland; spots and croakers and Spanish mackerel in Virginia.

Statement of the percentage of weight of certain products in each State compared with the total yield in the entire region.

Species.	New York.	New Jersey.	Pennsylvania.	Delaware.	Maryland.	Virginia.	Total.
Alewives	6.11	5.76	6.50	2.41	48.53	30.69	100.00
Bluefish	36.48	47.89			3.42	12.81	100.00
Catfish	4.36	4.98	4.92	2.74	48.22	34.78	100.00
Cod	73.03	26.97					100.00
Eels	47.99	18.51	1.22	6.64	23.52	2.12	100.00
Flounders	57.51	36.38		.19	1.23	4.69	100.00
Menhaden	39.94	7.87		.03	11.79	40.37	100.00
Perch, white	2.21	10.40	.32	11.43	59.54	16.10	100.00
Perch, yellow	2.17	23.19	.58	1.98	64.22	7.83	100.00
Sea bass	12.26	67.38	17.11		2.04	1.19	100.00
Shad	10.09	33.87	8.92	4.97	20.62	21.53	100.00
Spots and croakers	7.98	8.36			4.78	78.88	100.00
Spanish mackerel	.81	4.92		1.96	12.62	79.69	100.00
Squeteague	19.41	40.83		7.92	5.11	26.73	100.00
Striped bass	8.67	12.57	1.04	4.00	53.33	20.39	100.00
Sturgeon	1.15	17.17	1.99	49.49	2.75	27.45	100.00
Crabs, hard	7.57	4.00			48.29	40.14	100.00
Crabs, soft	1.59	4.92		1.46	82.07	9.96	100.00
Oysters	12.23	10.79	.79	.73	46.59	28.87	100.00
Soft clams or long clams	64.54	35.46					100.00
Quahogs or hard clams	51.96	39.67		.25	1.70	6.42	100.00
All other products	68.83	13.36	.52	2.95	5.13	9.21	100.00
All products	28.94	13.40	1.29	1.30	23.91	31.16	100.00

FISHERIES OF NEW YORK.

General features of the fisheries.—In the value of its fisheries New York ranks second among the States of the Middle Atlantic region and third in the entire country, being surpassed only by Maryland and Massachusetts.

Owing chiefly to the large coastal population, the proximity of the best markets, and the ready demand for nearly all forms of water products, there is probably no State whose fishery resources are more fully utilized than New York. Fishing is systematically prosecuted along all the shores of the State bordering on salt water and is also extensive in the Hudson River.

The fisheries which give special prominence to the State are those for fish and other animals inhabiting the rivers and inshore waters. The vessel fisheries in the open ocean, while very important, are practically restricted to the taking of menhaden with seines and bluefish and cod with lines. Chief among the products are oysters, hard clams, soft clams, scallops, shad, squeteague, and eels in addition to those mentioned.

The products in the value of which New York surpasses the other States of this region are scallops (which are taken only in this State), soft clams, hard clams, lobsters, butter-fish, eels, flounders, menhaden, and scup. In salt water the cultivation and taking of oysters is by far the most prominent branch of the fisheries, while in the fresh waters the capture of shad is the principal fishery.

Statistical summary.—Condensed statistics of the commercial fisheries of New York as they existed in the years 1889, 1890, and 1891 are shown in the following series of tables, relating respectively to the persons employed, the capital invested, and the products.

The fishing population of this State in 1891 was 12,246, an increase of somewhat more than 1,000 as compared with 1889. Vessel fishing engaged the attention of 2,250 persons, shore and boat fishing was participated in by 7,858 persons, shore fishery industries gave employment to 2,042 persons, and the transporting trade was conducted by 96 persons.

The investment in the fisheries of this State in 1891 was $5,283,200, or $705,977 more than in the second preceding year, thus compensating for the increase in the fishing population. The details of the investment are shown in the table, which indicates the items in which the changes have occurred during the three years.

In 1891 the yield of the fisheries of this State was 170,885,022 pounds, valued at $4,817,369. While the quantity of the catch was less than in 1889 or 1890, the value was considerably greater, owing to a larger catch of products with a relatively high valuation per pound.

Persons employed in the fisheries of New York.

How engaged.	1889.	1890.	1891.
In vessel fisheries	2,071	2,181	2,250
In shore fisheries	7,312	7,740	7,858
On transporting vessels	122	116	96
On shore, in factories, etc	1,715	1,904	2,042
Total	11,220	11,941	12,246

Vessels, boats, apparatus, shore property, and cash capital employed in the fisheries of New York.

Designation.	1889.		1890.		1891.	
	Number.	Value.	Number.	Value.	Number.	Value.
Vessels fishing	605	$714, 437	608	$769, 674	618	$773, 442
Tonnage	8, 081	....	8, 338	....	8, 496	....
Outfit	....	159, 451	....	164, 185	....	168, 388
Vessels transporting	52	52, 600	49	50, 780	41	44, 100
Tonnage	949	....	952	....	796	....
Outfit	....	7, 470	....	6, 580	....	5, 710
Boats	5, 750	344, 440	6, 036	368, 050	6, 227	373, 670
Apparatus—vessel fisheries:						
Purse seines	64	39, 250	71	40, 975	69	39, 850
Trap nets	79	28, 625	86	31, 750	90	32, 350
Lines	....	7, 230	....	8, 225	....	8, 870
Pots, lobster and eel	635	1, 540	509	1, 140	580	1, 385
Dredges, rakes, and tongs	....	44, 144	....	44, 638	....	43, 322
Apparatus—shore fisheries:						
Seines	292	42, 790	298	42, 135	258	35, 790
Gill nets	6, 694	98, 380	6, 656	96, 106	6, 402	88, 450
Fyke nets	6, 606	57, 023	6, 753	59, 202	6, 246	55, 465
Pound nets and trap nets	183	41, 350	189	41, 950	173	38, 990
Lines	....	2, 775	....	2, 780	....	2, 875
Eel pots	14, 980	15, 191	14, 894	15, 328	13, 568	13, 674
Lobster pots	1, 764	2, 461	1, 800	2, 419	1, 750	2, 332
Spears	4, 050	4, 193	3, 945	4, 120	3, 489	3, 728
Dredges	1, 165	13, 400	1, 334	13, 990	1, 475	15, 550
Rakes	3, 453	27, 229	3, 363	26, 815	3, 397	27, 650
Tongs	5, 090	29, 570	5, 313	30, 855	5, 512	31, 820
Forks	1, 333	1, 378	1, 401	1, 490	1, 475	1, 570
Minor apparatus	....	250	....	250	....	250
Scows, floats, etc	651	82, 962	698	90, 200	752	99, 314
Shore property	....	1, 353, 084	....	1, 573, 580	....	1, 695, 655
Cash capital	....	1, 406, 000	....	1, 575, 500	....	1, 679, 000
Total	....	4, 577, 223	....	5, 062, 717	....	5, 283, 200

Products of the fisheries of New York.

Species.	1889.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives	2, 522, 435	$29, 661	2, 288, 204	$24, 785	2, 194, 560	$23, 526
Bluefish	5, 027, 573	219, 592	5, 739, 757	249, 504	5, 506, 575	237, 010
Bonito	3, 125	250	2, 500	200	1, 750	150
Butter-fish	365, 562	11, 570	423, 674	13, 310	837, 246	12, 988
Catfish	119, 422	6, 259	115, 915	5, 059	117, 180	5, 144
Cod	1, 886, 289	75, 899	1, 938, 950	78, 595	2, 277, 458	89, 921
Eels	1, 745, 002	95, 964	1, 680, 083	101, 071	1, 616, 213	97, 999
Flounders	1, 427, 503	41, 755	1, 575, 824	45, 005	1, 561, 696	45, 231
Haddock	160, 450	4, 053	155, 720	3, 870	147, 730	3, 890
Kingfish	164, 505	11, 132	185, 997	13, 011	157, 541	10, 792
Mackerel	....	....	5, 000	400	....	....
Menhaden	115, 452, 296	298, 468	128, 736, 016	340, 958	104, 860, 114	295, 605
Minnows	66, 000	990	45, 100	750	25, 600	480
Mullet	191, 610	9, 443	182, 600	9, 033	160, 060	7, 878
Perch	84, 990	5, 761	92, 061	6, 509	88, 125	6, 329
Pike	7, 465	672	6, 840	615	8, 215	740
Scup	348, 316	6, 972	368, 843	7, 326	350, 858	7, 016
Sea bass	557, 841	30, 119	750, 829	40, 972	679, 180	35, 915
Shad	4, 332, 532	217, 988	3, 776, 975	190, 180	3, 044, 956	161, 209
Sheepshead	20, 926	3, 347	22, 788	3, 874	19, 523	3, 500
Skates	86, 432	1, 642	98, 625	1, 873	101, 897	2, 022
Spanish mackerel	68, 490	6, 510	76, 258	7, 040	74, 836	7, 255
Spots	13, 516	635	20, 954	837	17, 501	700
Squeteague	2, 802, 341	112, 356	2, 989, 711	117, 355	2, 852, 653	111, 301
Striped bass	212, 430	20, 734	207, 540	21, 046	205, 449	21, 389
Sturgeon	39, 988	1, 168	39, 336	1, 153	30, 261	929
Suckers	27, 265	1, 637	24, 969	1, 535	25, 378	1, 545
Tautog	181, 746	8, 453	179, 432	8, 255	171, 172	7, 618
Tomcod	241, 960	9, 084	308, 640	12, 215	278, 400	10, 468
Other fish	265, 418	10, 230	267, 170	10, 105	211, 391	7, 548
Refuse fish	1, 220, 439	2, 927	1, 342, 090	3, 142	1, 118, 913	2, 733
Crabs, hard	423, 133	6, 925	430, 016	7, 470	435, 566	7, 589
Crabs, soft	108, 433	4, 750	88, 466	3, 350	93, 500	3, 450
Lobsters	124, 023	12, 780	150, 400	14, 754	165, 093	15, 655
Mussels	1, 400	67	49, 350	1, 928	21, 000	900
Oysters	14, 628, 208	2, 132, 772	16, 456, 104	2, 457, 589	18, 277, 434	2, 748, 509
Quahogs or hard clams	4, 161, 164	602, 502	4, 202, 224	607, 129	4, 524, 520	650, 621
Soft clams or long clams	1, 411, 000	100, 190	1, 580, 000	103, 370	1, 505, 500	105, 891
Scallops	457, 425	62, 180	595, 890	71, 250	313, 042	48, 340
Squid	38, 945	1, 557	39, 140	1, 564	40, 836	1, 633
Shells	14, 944, 500	13, 800	15, 230, 700	14, 170	16, 766, 100	15, 950
Total	175, 936, 098	4, 181, 794	192, 470, 691	4, 602, 157	170, 885, 022	4, 817, 369

The quantities of oysters, clams, crabs, etc., taken in the fisheries of this State are specified by bushels or number in the following supplementary table:

Products.	1889.	1890.	1891.
Soft clams or long clams ....bushels..	141,100	158,000	150,550
Quahogs or hard clams ....do....	520,146	525,278	565,565
Oysters ....do....	2,089,744	2,350,872	2,611,062
Scallops ....do....	101,650	132,420	69,565
Mussels ....do....	140	4,935	2,100
Shells ....do....	332,100	338,460	372,580
Crabs, soft ....number..	325,299	265,398	280,500
Crabs, hard ....do....	1,269,399	1,290,048	1,306,698

Statistics of the fisheries by counties.—There are in New York six counties bordering on the ocean or on the bays and sounds tributary thereto, in all of which important fishing is carried on; these are Kings, New York, Queens, Richmond, Suffolk, and Westchester. Nine other counties abutting on the Hudson River have fisheries of considerable value; these are Albany, Columbia, Dutchess, Greene, Orange, Putnam, Rensselaer, Rockland, and Ulster. The extent of the fisheries in each of these is shown for the years 1890 and 1891 in the following series of tables.

The use of vessels is restricted to the six counties which border on salt water. Some forms of apparatus are found in every county, and others are operated in only a few localities. Thus gill nets, fyke nets, and eel pots are means of capture in every county except New York; while pound nets and traps are operated only in three counties on Long Island.

The preponderating importance of the fishing industry of Suffolk County is clearly brought out in the tables. Here, in 1891, 5,201 persons were employed in the fisheries, $1,787,444 was invested, 120,737,349 pounds of products were taken, and the value of the catch was $1,536,649. On comparing these figures with the total for the State, it appears that this county represents about 43 per cent of the fishing population, 34 per cent of the investment, and 32 per cent of the value of the industry.

Next to Suffolk County in importance are Queens, Kings, Richmond, Westchester, and New York counties, in the order named, in all of which the oyster is of prime importance, followed by the other products which give prominence to the salt-water fisheries of the State, as menhaden, bluefish, clams, etc. The counties maintaining the most extensive fisheries in the Hudson River are Dutchess, Ulster, Rockland, and Orange. The principal kinds of apparatus there used are seines, gill nets, and fyke nets, and the bulk of the catch consists of shad, alewives, and catfish.

Statement by counties of the number of persons employed in the fisheries of New York.

Counties.	In vessel fisheries.		In shore fisheries.		On transporting vessels.		On shore, in factories, etc.		Total.	
	1890.	1891.	1890.	1891.	1890.	1891.	1890.	1891.	1890.	1891.
Albany			65	64					65	64
Columbia			133	131					133	131
Dutchess			301	297					301	297
Greene			122	118					122	118
Kings	234	231	451	519	16	12	178	193	879	955
New York	112	115			9	9	795	887	916	1,011
Orange			124	113					124	113
Putnam			35	30					35	30
Queens	296	310	1,961	2,024	47	37	141	158	2,445	2,529
Rensselaer			64	62					64	62
Richmond	310	314	406	440	44	38			760	792
Rockland			146	143					146	143
Suffolk	1,155	1,209	3,175	3,188			790	804	5,120	5,201
Ulster			199	186					199	186
Westchester	74	71	558	543					632	614
Total	2,181	2,250	7,740	7,858	116	96	1,904	2,042	11,941	12,246

Statement by counties of the vessels, boats, apparatus, shore property, and cash capital employed in the fisheries of New York.

Designation.	Albany.				Columbia.				Dutchess.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Boats	15	$505	15	$485	54	$2,245	55	$2,150	163	$9.240	158	$8,715
Apparatus:												
Seines	10	1.025	7	775	16	1,470	14	1,220	9	1,900	7	1,600
Gill nets	245	426	255	448	290	2,594	301	2,375	518	12,440	533	11,656
Fyke nets	285	1,345	295	1,565	68	480	71	495	136	710	136	810
Eel pots	26	26	23	23	29	34	30	35	22	25	28	28
Scows, floats, etc	6	639	6	639	9	108	8	96	55	1,636	54	1,624
Shore property		570		453		1,113		1,232		2,060		1,935
Total		4,536		4,388		8,044		7,603		28,011		26,398

Designation.	Orange.				Putnam.				Queens.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing									119	$81,520	116	$82,220
Tonnage									1,102		1,120	
Outfit										14,875		14,500
Vessels transporting									19	20,300	15	16,500
Tonnage									417		330	
Outfit										1,900		1,500
Boats	64	$3,055	60	$3,005	16	$815	13	$580	2,069	109,260	2,158	110,035
Apparatus—vessel fisheries:												
Dredges, rakes, and tongs										8,470		8,521
Apparatus—shore fisheries:												
Seines									69	9,095	60	7,245
Gillnets	278	5,943	287	5,565	142	1,418	136	1,290	48	4,350	41	3,380
Fyke nets	167	1,006	156	933	21	109	17	102	275	2,825	213	2,340
Pound nets									5	1,000	4	800
Lines										225		210
Eel pots	33	41	31	35	13	13	13	13	3,265	3,418	2,910	3,053
Lobster pots									100	119	81	121
Spears									1,645	1,650	1,595	1,620
Dredges									515	5,900	600	6,500
Rakes									1,060	9,385	1,167	10 480
Tongs									1.575	9,120	1,605	9,440
Forks									500	544	543	593
Scows floats, etc									243	33,100	249	35,000
Shore property		1,150		975		125		125		40,900		44,400
Cash capital										105,000		110,000
Total		11,195		10,513		2,480		2,110		462,986		468,458

Designation.	Rensselaer.				Richmond.				Rockland.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing					119	$126,975	118	$125,850				
Tonnage					1,526		1,529					
Outfit						17,850		17,700				
Vessels transporting					18	19,700	16	17,900				
Tonnage					376		334					
Outfit						1,800		1,600				
Boats	18	$795	16	$715	398	39,000	433	42.500	113	$4,990	113	$4,325
Apparatus—vessel fisheries:												
Lines						580		490				
Pots (lobster)					390	900	440	1,050				
Dredges, rakes, and tongs						10,600		9 434				
Apparatus—shore fisheries:												
Seines	7	775	6	710	3	525	3	525				
Gill nets	275	480	253	444	252	1,260	240	1,200	817	4,565	745	4,050
Fyke nets	174	925	161	885	218	2,180	215	2,150	115	1,400	125	1,525
Lines						120		125				
Eel pots	27	27	20	20	350	350	335	335	48	48	43	43
Lobster pots					680	680	720	720				
Rakes					380	3,800	400	4,000				
Tongs					390	3,250	430	3,440				
Forks					35	35	30	30				
Scows, floats, etc	3	235	3	235	59	7,000	59	7,000				
Shore property		533		468		11,700		11,700		300		275
Total		3,770		3,477		248,305		247,749		11,303		10,218

Statement by counties of the vessels, boats, apparatus, shore property, and cash capital employed in the fisheries of New York—Continued.

Designation.	Greene.				Kings.				New York.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing					63	$84,200	61	$81,850	29	$64,429	29	$64,150
Tonnage					896		889		548		548	
Outfit						14,875		14,625		20,100		21,500
Vessels transporting					8	7,500	6	6,500	4	3,280	4	3,200
Tonnage					100		73		60		60	
Outfit						880		660		2,000		1,950
Boats	39	$2,005	38	$1,995	691	33,180	746	36,150				
Apparatus—vessel fisheries:												
Purse seines					11	7,600	11	7,900				
Lines						565		970		2,400		2,340
Pots (lobster and eel)					95	200	140	335	24	40		
Dredges, rakes, and tongs						2,855		2,610		1,920		1,985
Apparatus—shore fisheries:												
Seines	18	2,675	15	2,500								
Gill nets	316	1,918	338	1,884	153	10,170	151	10,200				
Fyke nets	52	290	52	290	218	1,962	205	1,860				
Pound nets					6	2,100	6	2,000				
Lines						225		215				
Eel pots	24	24	20	20	525	525	485	485				
Lobster pots					260	520	250	500				
Spears					310	285	225	210				
Dredges					475	4,750	540	5,400				
Rakes					175	1,050	175	1,050				
Tongs					650	4,550	775	5,425				
Forks					115	135	115	135				
Scows, floats, etc	10	120	9	108	85	12,250	112	16,100				
Shore property		751		664		36,500		38,500		1,085,000		1,190,000
Cash capital						62,000		70,000		967,000		1,023,000
Total		7,783		7,461		288,877		303,680		2,146,169		2,308,125

Designation.	Suffolk.				Ulster.				Westchester.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	249	$394,200	266	$401,522					29	$18,350	28	$17,850
Tonnage	4,009		4,166						258		246	
Outfit		93,585		97,363						2,900		2,700
Boats	1,933	133,175	1,959	133,120	95	$4,065	97	$4,225	368	25,720	366	25,670
Apparatus—vessel fisheries:												
Purse seines	60	33,375	58	31,950								
Trap nets	86	31,750	90	32,350								
Lines		4,680		5,070								
Dredges, rakes, and tongs		18,542		18,602						2,251		2,170
Apparatus—shore fisheries:												
Seines	151	22,425	134	19,165	12	1,195	9	1,000	3	1,050	3	1,050
Gill nets	848	27,135	785	23,815	429	6,070	390	5,608	2,015	17,337	1,945	16,535
Fyke nets	4,840	43,910	4,430	40,515	89	485	72	400	95	1,575	98	1,565
Pound nets	178	38,850	163	36,190								
Lines		2,160		2,220						110		105
Eel pots	10,237	10,499	9,329	9,279	45	48	41	45	250	250	260	260
Lobster pots	645	840	589	771					115	230	110	220
Spears	1,970	2,155	1,654	1,875					20	30	15	23
Dredges	239	2,590	275	3,050					75	750	60	600
Rakes	1,438	9,790	1,360	9,465					310	2,790	295	2,655
Tongs	2,438	12,115	2,477	11,940					260	1,820	225	1,575
Forks	711	736	757	782					40	40	30	30
Minor apparatus		250		250								
Scows, floats, etc	171	25,800	195	29,200	6	72	6	72	51	9,240	51	9,240
Shore property		390,850		402,950		1,778		1,728		250		250
Cash capital		441,500		476,000								
Total		1,740,852		1,787,444		13,713		13,078		84,693		82,498

Statement by counties of the vessels, boats, apparatus, shore property, and cash capital employed in the fisheries of New York—Continued.

Designation.	Total for State. 1890. No.	Total for State. 1890. Value.	Total for State. 1891. No.	Total for State. 1891. Value.
Vessels fishing	608	$769, 674	618	$773, 442
Tonnage	8, 338		8, 496	
Outfit		164, 185		168, 388
Vessels transporting	49	50, 780	41	44, 100
Tonnage	952		796	
Outfit		6, 580		5, 710
Boats	6, 036	368, 050	6, 227	373, 670
Apparatus—vessel fisheries:				
Purse seines	71	40, 975	69	39, 850
Trap nets	86	31, 750	90	32, 350
Lines		8, 225		8, 870
Pots (lobster and eel)	509	1, 140	580	1, 385
Dredges, rakes, and tongs		44, 638		43, 322
Apparatus—shore fisheries:				
Seines	298	42, 135	258	35, 790
Gill nets	6, 656	96, 106	6, 402	88, 450

Designation.	Total for State. 1890. No.	Total for State. 1890. Value.	Total for State. 1891. No.	Total for State. 1891. Value.
Apparatus—shore fisheries—Continued.				
Fyke nets	6, 753	$59, 202	6, 246	$55, 465
Pound nets	189	41, 950	173	38, 990
Lines		2, 780		2, 875
Eel pots	14, 894	15, 328	13, 568	13, 674
Lobster pots	1, 800	2, 419	1, 750	2, 332
Spears	3, 945	4, 120	3, 489	3, 728
Dredges	1, 334	13, 990	1, 475	15, 550
Rakes	3, 363	26, 815	3, 397	27, 650
Tongs	5, 313	30, 855	5. 512	31, 820
Forks	1, 401	1, 490	1, 475	1, 570
Minor apparatus		250		250
Scows, floats, etc	698	90, 200	752	99, 314
Shore property		1, 573, 580		1, 695, 655
Cash capital		1, 575, 500		1, 679, 000
Total		5, 062, 717		5, 283, 200

Statement by counties and species of the yield of the fisheries of New York.

Species.	Albany. 1890. Pounds.	Albany. 1890. Value.	Albany. 1891. Pounds.	Albany. 1891. Value.	Columbia. 1890. Pounds.	Columbia. 1890. Value.	Columbia. 1891. Pounds.	Columbia. 1891. Value.	Dutchess. 1890. Pounds.	Dutchess. 1890. Value.	Dutchess. 1891. Pounds.	Dutchess. 1891. Value.
Alewives	120, 700	$1, 539	121, 366	$1. 537	230, 000	$3, 122	168, 440	$2, 133.	154, 033	$1, 950	146, 933	$1, 904
Catfish	7, 453	385	7, 855	406	10, 578	560	10, 530	554	5, 742	286	6, 100	305
Eels	780	55	825	58	940	56	950	57	675	47	725	51
Perch	5, 542	462	5, 915	492	9, 736	666	9, 180	613	3, 488	285	3, 890	303
Shad	3, 300	165	1, 600	80	70, 400	3, 480	49, 500	2, 485	659, 600	32, 980	287, 800	20, 390
Striped bass	4, 118	494	3, 500	420	1, 419	170	1, 330	160	1, 863	223	1, 815	218
Sturgeon	250	10	150	6	1, 050	42	980	39	1, 460	58	1, 375	55
Suckers	4, 067	235	4, 120	228	2, 228	139	2, 558	165	2, 621	167	2, 780	178
Other fish	4, 282	285	4, 095	268	5, 682	187	5, 915	212	1, 767	122	2, 660	161
Total	150, 492	3, 630	149, 426	3, 495	332, 033	8, 422	249, 383	6, 418	831, 249	36, 118	454, 078	23, 565

Species.	Greene. 1890. Pounds.	Greene. 1890. Value.	Greene. 1891. Pounds.	Greene. 1891. Value.	Kings. 1890. Pounds.	Kings. 1890. Value.	Kings. 1891. Pounds.	Kings. 1891. Value.	New York. 1890. Pounds.	New York. 1890. Value.	New York. 1891. Pounds.	New York. 1891. Value.
Alewives	336,233	$4,324	328,633	$4,236								
Bluefish					219,570	$8,826	94,500	$5,050	431,000	$22,120	409,000	$19, 160
Butter-fish					5,000	200	12,500	500				
Catfish	5,178	282	5,167	283	14,474	572	13,120	520				
Cod					172,200	7,362	167,507	7,510	437,500	15,910	458,670	16, 085
Eels	675	41	575	35	91,328	6,166	78,141	5,105	6,000	500		
Flounders					26,156	924	28,040	1,035				
Haddock									94,000	1,700	87,000	1, 650
Mackerel					5,000	400						
Menhaden					21,960,000	65,880	22,380,000	70,870				
Perch	6,287	482	6,312	484	5,246	196	4,460	170				
Sea bass					500	30	500	30	155,000	6,400	142,500	6, 280
Shad	56,500	2,825	42,800	2,140	166,564	8,672	147,360	7,660				
Squeteague					13,689	783	13,180	713				
Striped bass	1,828	222	1,725	194	5,320	693	4,920	617				
Suckers	1,760	116	1,730	114								
Tautog					1,430	73	1,130	60				
Tomcod					800	36	1,230	50				
Other fish	4,669	181	4,271	139	12,665	419	12,693	435				
Lobsters					6,920	625	5,730	575				
Crabs, hard					118,416	2,475	85,400	2,229				
Crabs, soft					33,466	1,600	40,166	1,750				
Oysters					3,386,845	636,435	3,781,120	725,860	859,250	120,350	890,750	126, 265
Soft clams					127,000	11,460	117,000	10,581				
Quahogs					349,600	43,702	385,800	48,553	25,840	2,960	24,640	29810
Mussels					42,000	1,700	21,000	900				
Total	413,130	8,473	391,213	7,625	26,764,189	799,229	27,395,497	890,773	2,008,590	169,940	2,012,560	172, 250

Statement by counties and species of the yield of the fisheries of New York—Continued.

Species.	Orange.				Putnam.				Queens.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives									206, 667	$1, 550	163, 333	$1, 225
Bluefish									609, 208	29, 278	530, 145	24, 687
Catfish	5, 157	$257	4, 820	$241	1, 865	$92	2, 050	$102	12, 996	444	12, 955	460
Cod									82, 000	3, 800	68, 750	3, 350
Eels	1, 150	80	1, 080	75	375	26	575	40	429, 303	25, 931	422, 120	25, 514
Flounders									166, 047	6. 979	143, 472	6, 099
Kingfish									63, 993	4, 439	58, 247	3, 734
Mullet									40, 600	1, 933	37, 560	1, 778
Perch	3, 249	283	3, 035	277	1, 552	124	1, 685	142	9, 320	475	9. 000	452
Sea bass									69, 360	5, 899	59, 434	3, 256
Shad	259, 600	12, 980	149, 200	7, 460	55, 100	2, 755	31, 156	1, 558	29, 925	1, 859	27, 285	1, 704
Spanish mack'l									20, 471	1, 433	17, 605	1, 231
Squeteague									361, 516	20, 774	309. 056	18, 083
Striped bass	1. 161	140	1, 070	130	1. 028	123	925	111	57, 403	4, 279	49. 789	4, 662
Sturgeon	975	39	1, 050	42	835	33	925	37				
Suckers	2, 119	135	2, 050	132	980	67	850	56				
Tautog									44, 600	2, 652	39, 755	2, 182
Tomcod or frost-fish									70, 880	3, 246	68, 690	2, 749
Other fish	1, 700	119	1, 775	121	1, 527	129	1, 300	107	45, 440	1, 990	18, 721	692
Lobsters									6, 320	575	4, 840	485
Oysters									4, 511, 619	735, 804	4, 636, 135	745, 944
Soft clams									500, 000	33, 770	553, 000	37, 735
Quahogs									1, 829, 184	282, 599	2, 084, 280	321, 215
Mussels									7, 350	228		
Total	275, 111	14, 033	164, 080	8, 478	63, 262	3, 349	39, 466	2. 153	9. 174, 202	1, 169, 937	9, 314, 172	1, 207, 237

Species.	Suffolk.				Ulster.				Westchester.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Alewives	837,451	$7,157	828,323	$6,923	172,233	$2,201	177,233	$2,260	115,267	$1,470	150,166	$1,914
Bluefish	4,199,979	176,570	4,202,930	175,903								
Bonito	2,500	200	1,750	150								
Butter fish	418.674	13,110	824,746	12,488								
Catfish	16,225	392	17,610	453	7,206	379	7,313	384	6,840	346	7,730	388
Cod	1,178 350	48.743	1,420,531	56,716								
Eels	1,081,427	62,695	1,047,720	61,924	975	58	875	52	36,000	3,600	33,500	3,350
Flounders	1,340,526	35,092	1,351,039	36.327					34,470	1,710	31,365	1,495
Haddock	44,320	1,770	44,230	1,815								
Kingfish	122,004	8,572	99,294	7,058								
Menhaden	106,776,016	275,078	82,480.114	224,735								
Minnows	45,100	750	25,600	480								
Mullet	142,000	7.100	122,500	6,100								
Perch	14,300	1,040	12,500	984	5,109	390	5,076	404	15,275	1,198	14,285	1,110
Scup	368,843	7,326	350,858	7,016								
Sea bass	515,969	28.203	476,746	26.349								
Shad	113,524	6,205	98,005	7,094	369,000	18,450	252,020	12,585	1,646,150	82,308	1,595,600	79,780
Sheepshead	22,788	3,874	19,523	3,500								
Skates	98,625	1,873	101,897	2,022								
Spanish mackerel	55,787	5,607	57,231	6,024								
Spot	20,954	837	17,501	700								
Squeteague	2,499,561	89,748	2,440,497	88,010								
Striped bass	84,108	8.968	93,392	9,442	1,555	186	1.685	202	25,115	3,013	20,580	2.469
Sturgeon	29,801	773	21,001	559	1,250	50	1,050	42	1,550	62	1,600	64
Suckers					1,847	132	2.000	144	3,040	136	3,340	148
Tautog	117,687	4,750	117,247	4,726					12,300	610	10,040	500
Tomcod or frost-fish	198,028	7,025	168,280	5,794					36,802	1,840	37,000	1,775
Other fish	176,166	6,285	148,080	5,123	2,329	102	3,061	170	4,397	241	4,160	219
Refuse fish	1,342,090	3,142	1,118,913	2,733								
Lobsters	27,588	2,646	24,498	2,435					12,000	1,500	10,000	1,250
Crabs, hard	311,600	4,995	350,166	5,360								
Crabs, sof	55,000	1,750	53,334	1,700								
Oysters	2,671,515	370,458	3,310,615	460,740					1,085,000	123,500	980,000	112,000
Soft clams	848,000	50,240	757,500	51,895					40,000	4,000	25,000	2,500
Quahogs	1,372,200	186,388	1,413,200	187,448					388,000	62,250	368,000	59,000
Scallops	595,890	71,250	313,042	48.340								
Squid	39,140	1.564	40,836	1,633								
Shells	15,230,700	14,170	16,766,100	15,950								
Total	143,014,436	1,516,346	120,737,349	1,536,649	561.504	21,948	450,313	16,243	3,462,206	287,784	3,292,366	267,962

Statement by counties and species of the yield of the fisheries of New York—Continued.

Species.	Rensselaer.				Richmond.				Rockland.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives	108, 700	$1, 385	103, 733	$1, 314	6, 920	$87	6, 400	$80				
Bluefish					280, 000	12, 710	270, 000	12, 210				
Catfish	9, 730	517	9, 820	518	8. 475	348	8, 510	350	3, 996	$199	3, 600	$180
Cod					68, 900	2, 780	162, 000	6, 260				
Eels	850	59	750	53	27, 320	1, 597	26. 163	1, 530	2, 285	160	2, 214	155
Flounders					8, 625	300	7, 780	275				
Haddock					17, 400	400	16, 500	425				
Perch	5, 072	427	5, 265	448	4, 765	220	4, 762	221	3, 120	261	2, 760	229
Sea bass					10, 000	440						
Shad					58, 792	3, 075	77, 680	3, 995	288, 520	14, 426	285, 550	14, 278
Squeteague					114. 945	6. 050	89, 920	4, 495				
Striped bass	3, 489	418	3, 835	460	16, 302	1, 780	18, 458	2, 005	2, 831	337	2, 425	299
Sturgeon	250	10	180	7					1, 915	76	1, 950	78
Suckers	3, 351	216	3, 425	218					2, 956	192	2, 525	162
Tautog					3, 415	170	3. 000	150				
Tomcod					2. 130	68	3, 200	100				
Other fish	6, 204	384	6, 195	394	5, 750	180	5. 415	157	1, 432	96	1, 265	90
Lobsters					97, 572	9, 408	120, 025	10, 910				
Oysters					3, 941, 875	471, 042	4, 678, 814	577, 700				
Soft clams					65. 000	3, 900	53, 000	3, 180				
Quahogs					237, 400	29, 230	248, 600	31, 595				
Total	137, 646	3, 416	133, 203	3, 412	4, 975 586	543. 785	5, 799, 627	655, 638	307, 055	15, 747	302, 289	15, 471

SUMMARY.

Species.	1890.		1891.		Species.	1890.		1891.	
	Lbs.	Value.	Lbs.	Value.		Lbs.	Value.	Lbs.	Value.
Alewives	2,288,204	$24,785	2,194,560	$23,526	Squeteague	2,989,711	$117,355	2,852,653	$111,301
Bluefish	5,739.757	249,504	5,506,575	237,010	Striped bass	207,540	21,046	205,449	21,389
Bonito	2,500	200	1,750	150	Sturgeon	39,336	1,153	30,261	929
Butter-fish	423,674	13,310	837,246	12,988	Suckers	24,969	1,535	25,378	1,545
Catfish	115,915	5,059	117,180	5,144	Tautog	179,432	8,255	171,172	7,618
Codfish	1,938,950	78,595	2,277,458	89,921	Tomcod or frostfish	308,640	12,215	278,400	10,468
Eels	1,680,083	101,071	1,616,213	97,999	Other fish	274,010	10,720	219,606	8,288
Flounders	1,575,824	45,005	1,561,696	45,231	Refuse fish	1,342,090	3.142	1,118,913	2,733
Haddock	155,720	3,870	147,730	3,890	Lobsters	150.400	14,751	165,093	15 655
Kingfish	185,997	13,011	157,541	10,792	Crabs, hard	430.016	7,470	435,566	7,589
Mackerel	5,000	400			Crabs, soft	88,466	3,350	93,500	3,450
Menhaden	128,736,016	340,958	104,860,114	295,605	Oysters	16,456,104	2,457,589	18,277,434	2,748,509
Minnows	45,100	750	25,600	480	Soft clams or long				
Mullet	182,600	9,033	160,060	7,878	clams	1,580,000	103,370	1,505,500	105,891
Perch	92,061	6,509	88,125	6,329	Quahogs or hard				
Scup	368,843	7,326	350,858	7,016	clams	4,202,224	607,129	4,524,520	650,621
Sea bass	750,829	40,972	679,180	35,915	Scallops	595,899	71,250	313,042	48,340
Shad	3,776,975	190,180	3,044,956	161,209	Squid	39,140	1,564	40,836	1,633
Sheepshead	22,788	3,874	19.523	3,500	Mussels	49,350	1,928	21,000	900
Skates	98,625	1,873	101,897	2,022	Shells	15,230,700	14,170	16,766,100	15,950
Spanish mackerel	76.258	7,040	74,836	7.255					
Spot	20,954	837	17,501	700	Total	192,470,691	4,602,157	170,885,022	4,817,369

Statistics of the products by each form of apparatus.—In preceding tables the importance of each principal form of apparatus employed in the fisheries of this State has been shown. In the following tables the details of the quantity and value of the products taken with the various appliances are given for each county, the vessel fisheries and the shore fisheries being separately indicated.

Much the larger part of the vessel fishing is done with dredges, rakes, and tongs for oysters, clams, scallops, mussels, and shells, and in Queens and Westchester counties vessels are only used for those products. In Kings, New York, Richmond, and Suffolk counties there is additional vessel fishing with seines, lines, trap nets, and pots for menhaden, bluefish, cod, haddock, sea bass, lobsters, etc. The value of the vessel fisheries of the State in 1891 was $1,965,228, of which sum $1,352,769 represented shellfish. Seines are employed for menhaden in Kings and Suffolk counties, taking 99,057,690 pounds of fish in 1891, having a value of $288,123. Lines

are extensively used in all but two counties, chiefly for bluefish, cod, haddock, and sea bass. The catch in 1891 was 5,660,870 pounds, worth $228,263. Eels are taken with pots in Kings County, and lobsters with the same means in Richmond County. A vessel fishery of great interest and value is that carried on from Suffolk County with trap nets, which are operated in a manner entirely similar to that in which gill nets or other nets are used from vessels. The nets, to the number of 90 in 1891, are set at the eastern end of Long Island, and take large quantities of all the fish common to those waters, the principal part of the catch consisting of squeteague, bluefish, butter-fish, flounders, scup, sea bass, and menhaden. The yield in 1891 was 7,200,080 pounds, valued at $84,413.

The yield of the shore fisheries in 1891 was 32,030,141 pounds, having a value of $2,852,141. The catch of the various mollusks and crustaceans was 15,191,386 pounds, worth $2,234,241. Considering the output of fish, it appears that gill nets take the largest quantities and give the greatest money returns of all the forms of apparatus employed. The fishes thus obtained which are caught in largest quantities are the shad, bluefish, squeteague, and alewives. The aggregate gill-net catch was 4,953,280 pounds, valued at $222,014. The quantity and value of the seine yield come next; 4,130,684 pounds, worth $157,828, were secured in this kind of apparatus. The species which enter most conspicuously into the seine fishery are alewives, bluefish, kingfish, mullet, sea bass, shad, squeteague, and tomcod, the most important being bluefish and squeteague. Pound nets took 2,742,412 pounds in 1891 and 3,228,198 pounds in 1890, valued, respectively, at $40,849 and $43,829; squeteague is the most prominent fish thus taken, although the menhaden is caught in larger quantities. Fyke nets yield larger money returns than pound nets, but the catch is smaller. Flounders constitute the largest and most valuable part of the output. The fyke-net yield was 2,382,882 pounds, worth $48,903. The catch of eels with pots is very large, 957,331 pounds, valued at $58,441, being secured in 1891. Spears took eels to the value of $32,123, and flounders worth $9,026. The line catch was 995,735 pounds of bluefish, cod, squeteague, etc., valued at $48,716.

Statement by counties, apparatus, and species of the yield of the vessel fisheries of New York.

Apparatus and species.	Kings.				New York.			
	1890.		1891.		1890.		1891.	
	Pounds.	Value	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:								
Menhaden	21,960,000	$65,880	22,380,000	$70,870				
Lines:								
Bluefish	196,950	7,695	86,000	4,625	431,000	$22,120	409,000	$19,160
Cod	164,500	6,900	158,340	6,960	437,500	15,910	458,670	16,085
Haddock					94,000	1,700	87,000	1,650
Mackerel	5,000	400						
Sea bass	500	30	500	30	155,000	6,400	142,500	6,280
Tautog	300	15	300	15				
Total	367,250	15,040	245,140	11,630	1,117,500	46,130	1,097,170	43,175
Pots:								
Eels	25,700	2,325	17,700	1,560	6,000	500		
Tongs, rakes, and dredges:								
Oysters	828,345	119,685	729,120	111,540	859,250	120,350	890,750	126,265
Quahogs or hard clams	81,200	9,890	69,200	8,735	25,840	2,960	24,640	2,810
Mussels	42,000	1,700	21,000	900				
Total	951,545	131,275	819,320	121,175	885,090	123,310	915,390	129,075
Grand total	23,304,495	214,520	23,462,160	205,235	2,008,590	169,940	2,012,560	172,250

Statement by counties, apparatus, and species of the yield of the vessel fisheries of New York—Continued.

Apparatus and species.	Queens.				Richmond.			
	1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Lines:								
Bluefish					280,000	$12,710	270,000	$12,210
Cod					68,900	2,780	162,000	6,260
Haddock					17,400	400	16,500	425
Sea bass					10,000	440		
Total					376,300	16,330	448,500	18,895
Pots:								
Lobsters					88,312	8,520	111,875	10,100
Tongs, rakes, and dredges:								
Oysters	1,591,219	$225,624	1,612,065	$221,604	3,101,175	368,322	3,726,814	452,450
Quahogs or hard clams	292,544	46,324	299,320	46,435	163,800	17,730	180,600	20,970
Mussels	7,350	228						
Total	1,891,113	272,176	1,911,385	268,039	3,264,975	386,052	3,907,414	473,420
Grand total	1,891,113	272,176	1,911,385	268,039	3,729,587	410,902	4,467,789	502,415

Apparatus and species.	Suffolk.				Westchester.			
	1890.		1891		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:								
Menhaden	100,172,100	$267,125	76,677,690	$217,253				
Lines:								
Bluefish	2,295,400	91,816	2,501,350	100,054				
Cod	1,019,175	41,831	1,281,300	50,652				
Haddock	30,800	1,432	32,910	1,532				
Sea bass	59,237	2,369	54,500	2,325				
Total	3,404,612	137,448	3,870,060	154,563				
Trap nets:								
Alewives	23,021	414	20,305	380				
Bluefish	117,006	4,564	104,860	4,194				
Butter-fish	263,368	8,691	559,249	8,388				
Eels	58,676	2,699	54,006	2,520				
Flounders and flatfish	165,032	2,805	151,312	2,268				
Kingfish	10,449	1,568	8,763	1,315				
Menhaden	4,238,264	5,084	3,849,440	4,804				
Scup	233,800	4,676	223,440	4,468				
Sea bass	106,960	5,348	101,144	5,107				
Shad	6,160	616	4,732	504				
Sheepshead	16,139	2,744	14,056	2,520				
Skate	69,848	1,327	73,360	1,456				
Spanish mackerel	7,369	1,769	7,817	1,954				
Spot	14,840	593	12,600	504				
Squeteague	1,105,440	33,163	1,110,110	33,303				
Striped bass	34,115	4,435	32,648	4,244				
Sturgeon	21,106	548	15,120	403				
Tautog	47,460	1,898	52,500	2,100				
Other fish	41,732	856	37,070	779				
Refuse fish	883,869	2,044	734,884	1,774				
Lobsters	4,071	313	3,264	252				
Squid	27,720	1,108	29,400	1,176				
Total	7,496,445	87,263	7,200,080	84,413				
Tongs, rakes, and dredges:								
Oysters	1,382,465	190,508	1,597,015	219,690	455,000	$58,500	420,000	$54,000
Quahogs or hard clams	89,600	11,688	109,000	14,080	52,000	9,750	48,000	9,000
Scallops	595,890	71,250	313,042	48,340				
Shells	15,230,700	14,170	16,766,100	15,950				
Total	17,298,655	287,616	18,785,157	298,060	507,000	68,250	468,000	63,000
Grand total	128,371,812	779,452	106,532,987	754,289	507,000	68,250	468,000	63,000

Statement by counties, apparatus, and species of the yield of the vessel fisheries of New York—Continued.

Apparatus and species.	Total for State. 1890. Pounds.	Total for State. 1890. Value.	Total for State. 1891. Pounds.	Total for State. 1891. Value.
Trap nets:				
Alewives	23,021	$414	20,305	$380
Bluefish	117,006	4,564	104,860	4,194
Butter-fish	263,368	8,691	559,249	8,388
Eels	58,676	2,699	54,006	2,520
Flounders	165,032	2,805	151,312	2,268
Kingfish	10,449	1,568	8,763	1,315
Menhaden	4,238,264	5,084	3,849,440	4,804
Scup	233,800	4,676	223,440	4,468
Sea bass	106,960	5,348	101,144	5,107
Shad	6,160	616	4,732	504
Sheepshead	16,139	2,744	14,056	2,520
Skate	69,848	1,327	73 360	1,456
Spanish mackerel	7,369	1,769	7,817	1,954
Spot	14,840	593	12,600	504
Squeteague	1,105,440	33,163	1,110,110	33,303
Striped bass	34,115	4,435	32,648	4,244
Sturgeon	21 106	548	15,120	403
Tautog	47,460	1,898	52,500	2,100
Other fish	41,732	856	37,070	779
Refuse fish	883,869	2,044	734,884	1,774
Lobsters	4,071	313	3,264	252
Squid	27,720	1,108	29,400	1,176
Total	7,496,445	87,263	7,200,080	84,413
Seines:				
Menhaden	122,132,100	333,005	99,057,690	288,123
Lines:				
Bluefish	3,203,350	$134,341	3,266,350	$136,049
Cod	1,690,075	67,421	2,060,310	79,957
Haddock	142,200	3,552	136,410	3,607
Mackerel	5,000	400	....	....
Sea bass	224,737	9,239	197,500	8,635
Tautog	300	15	300	15
Total	5,265,662	214,948	5,660,870	228,263
Pots:				
Eels	31,700	2,825	17,700	1,560
Lobsters	88,312	8,520	111,875	10,100
Total	120,012	11,345	129,575	11,660
Tongs, rakes, and dredges:				
Oysters	8,217,454	1,082,989	8,975,764	1,185,549
Quahogs	704,984	98,342	730,760	102,030
Scallops	595,890	71,250	313,042	48,340
Shells	15,230,700	14,170	16,766,100	15,950
Mussels	49,350	1,928	21,000	900
Total	24,798,378	1,268,679	26,806,666	1,352,769
Grand total	159,812,597	1,915,240	138,854,881	1,965,228

Statement by counties, apparatus, and species of the yield of the shore fisheries of New York.

Apparatus and species.	Albany. 1890. Pounds.	Albany. 1890. Value.	Albany. 1891. Pounds.	Albany. 1891. Value.	Columbia. 1890. Pounds.	Columbia. 1890. Value.	Columbia. 1891. Pounds.	Columbia. 1891. Value.	Dutchess. 1890. Pounds.	Dutchess. 1890. Value.	Dutchess. 1891. Pounds.	Dutchess. 1891. Value.
Seines:												
Alewives	120,700	$1,539	121,366	$1,537	207,833	$2,829	149,433	$1,889	154,033	$1,950	146,933	$1,904
Catfish	1,250	75	1,325	79	4,550	273	4,250	255	2,250	112	2,500	125
Perch	1,500	120	1,600	128	5,150	283	4,980	269	980	59	1,500	90
Shad	3,300	165	1,600	80	38,300	1,875	26,800	1,350	93,200	4,660	33,600	1,680
Striped bass	1,800	216	1,200	144	....	....	....	....	....	....	....	....
Other fish	2,250	110	2,275	112	4,000	79	4,145	101	770	29	1,500	60
Total	130,800	2,225	129,366	2,080	259,833	5,339	189,608	3,864	251,233	6,810	186,033	3,859
Gill nets:												
Alewives	....	....	....	....	22,167	293	19,007	244	....	....	....	....
Perch	2,570	225	2,765	240	1,850	161	1,350	112	1,175	120	1,015	103
Shad	....	....	....	....	32,100	1,605	22,700	1,135	566,400	28,320	254,200	18,710
Striped bass	2,200	264	2,175	261	1,175	141	1,075	129	1,800	216	1,750	210
Sturgeon	250	10	150	6	1,050	42	980	39	1,460	58	1,375	55
Suckers	875	70	760	60	675	54	940	76	875	70	980	78
Other fish	1,880	173	1,660	153	1,375	93	1,450	95	915	89	1,075	96
Total	7,775	742	7,510	720	60,392	2,389	47,502	1,830	572,625	28,873	260,395	19,252
Fyke nets:												
Catfish	6,203	310	6,530	327	6,028	287	6,280	299	3,492	174	3,600	180
Perch	1,472	117	1,550	124	2,736	222	2,850	232	1,333	106	1,375	110
Striped bass	118	14	125	15	244	29	255	31	63	7	65	8
Suckers	3,192	165	3,360	168	1,553	85	1,618	89	1,746	97	1,800	100
Other fish	152	2	160	3	307	15	320	16	82	4	85	5
Total	11,137	608	11,725	637	10,868	638	11,323	667	6,716	388	6,925	403
Pots:												
Eels	780	55	825	58	940	56	950	57	675	47	725	51
Grand total	150,492	3,630	149,426	3,495	332,033	8,422	249,383	6,418	831,249	36,118	454,078	23,565

Statement by counties, apparatus, and species of the yield of the shore fisheries of New York—Continued.

Apparatus and species.	Greene.				Kings.				Orange.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Alewives	286, 233	$3, 687	275, 133	$3, 562								
Catfish	2, 318	139	2, 417	145								
Perch	2, 987	179	3, 112	187								
Shad	41, 600	2, 080	33, 600	1, 680								
Other fish	2, 695	82	2, 671	78								
Total	335, 833	6, 167	316, 933	5, 652								
Gill nets:												
Alewives	50, 000	637	53, 500	674								
Perch	2, 130	210	2, 075	207					1, 350	$135	1, 260	$126
Shad	14, 900	745	9, 200	460	130, 000	$6, 500	118, 000	$5, 900	259, 600	12, 980	149, 200	7, 460
Striped bass	1, 750	210	1, 650	185					1, 060	127	975	117
Sturgeon									975	39	1, 050	42
Suckers	980	78	950	76					675	54	700	56
Other fish	1, 870	93	1, 500	55					1, 540	111	1, 625	113
Total	71, 630	1, 973	68, 875	1, 657	130, 000	6, 500	118. 000	5, 900	265, 200	13, 446	154, 810	7, 914
Pound nets:												
Bluefish					18, 000	900	3, 000	150				
Butter-fish					5, 000	200	12, 500	500				
Flounders					5, 000	300	7, 500	450				
Shad					9, 000	450	6, 000	300				
Squeteague					4. 725	350	3, 750	300				
Total					41. 725	2, 200	32, 750	1, 700				
Fyke nets:												
Catfish	2, 860	143	2, 750	138	10, 974	424	9, 300	360	5 157	257	4, 820	241
Eels					12. 811	672	10, 857	570				
Flounders					12. 083	330	10, 240	280				
Perch	1, 170	93	1, 125	90	3, 481	129	2, 950	110	1, 899	148	1, 775	151
Shad					27, 564	1, 722	23, 360	1, 460				
Squeteague					5, 864	283	4, 970	240				
Striped bass	78	12	75	9	4, 720	613	4, 000	520	101	13	95	13
Suckers	780	38	780	38					1, 444	81	1, 350	76
Other fish	104	6	100	6	6, 865	188	5, 818	160	160	8	150	8
Total	4, 992	292	4, 830	281	84, 362	4, 361	71, 495	3, 700	8, 761	507	8, 190	489
Lines:												
Bluefish					4, 620	231	5, 500	275				
Catfish					3, 500	148	3, 820	160				
Cod					7, 700	462	9, 167	550				
Flounders					8, 140	238	10, 300	305				
Perch					1, 765	67	1, 510	60				
Squeteague					3, 100	150	4, 460	173				
Striped bass					600	80	920	97				
Tautog					1, 130	58	830	45				
Tomcod					800	36	1, 230	50				
Other fish					5, 800	231	6, 875	275				
Total					37, 155	1, 701	44, 612	1, 990				
Spears:												
Eels					22, 817	1. 369	17. 084	1, 025				
Flounders					933	56						
Total					23, 750	1, 425	17, 084	1, 025				
Pots:												
Eels	675	41	575	35	30, 000	1. 800	32, 500	1, 950	1, 150	80	1, 080	75
Miscellaneous:												
Oysters					2,558,500	516, 750	3,052,000	614, 320				
Soft clams or long clams					127, 000	11, 460	117, 000	10, 581				
Quahogs or hard clams					268, 400	33, 812	316, 600	39. 818				
Lobsters					6. 920	625	5, 730	575				
Crabs, hard					118. 416	2, 475	85, 400	2, 229				
Crabs, soft					33, 466	1, 600	40. 166	1, 750				
Total					3,112,702	566, 722	3,616,896	669, 273				
Grand total	413, 130	8. 473	391, 213	7, 625	3,459,694	584, 709	3,933,337	685, 538	275, 111	14, 033	164, 080	8, 478

Statement by counties, apparatus, and species of the yield of the shore fisheries of New York—Continued.

Apparatus and species.	Putnam.				Queens.				Rensselaer.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Alewives									108, 700	$1, 385	103, 733	$1, 314
Bluefish					319, 875	$14, 528	265, 115	$11, 612				
Catfish									4, 150	249	3, 820	229
Eels					2, 260	132	1, 648	90				
Flounders					1, 200	60	900	40				
Kingfish					59, 783	4, 199	51, 817	3, 409				
Mullet					40, 600	1, 933	37, 560	1, 778				
Perch					9, 320	475	9, 000	452	1, 060	84	975	78
Sea bass					61, 360	5, 499	52, 434	2, 906				
Shad					6, 342	444	6, 685	468				
Spanish mack'l					20, 471	1, 433	17, 605	1, 231				
Squeteague					115, 078	6, 774	80, 563	4, 863				
Striped bass					44, 685	3, 128	36, 029	3, 482	1, 050	126	1, 500	180
Tomcod					65, 200	3, 016	61, 650	2, 466				
Other fish					33, 600	1, 652	7, 880	389	4, 065	195	3, 930	196
Total					779, 774	43, 273	628, 916	33, 186	119, 025	2, 039	113, 958	1, 997
Gill nets:												
Alewives					206, 667	1, 550	163, 333	1, 225				
Bluefish					269, 333	13, 950	247, 500	12, 375				
Perch	1, 075	$86	1, 160	$100					2, 385	213	2, 540	230
Shad	55, 100	2, 755	31, 156	1, 558								
Squeteague					103, 428	6, 000	101, 143	6, 100				
Striped bass	960	115	850	102					2, 360	283	2, 250	270
Sturgeon	835	33	925	37					250	10	180	7
Suckers	525	42	350	28					1, 050	84	950	76
Other fish	1, 450	125	1, 215	102					2, 070	186	2, 190	194
Total	59, 945	3, 156	35, 656	1, 927	579, 428	21, 500	511, 976	19, 700	8, 115	776	8, 110	777
Pound nets:												
Flounders					900	46	860	44				
Shad					23, 583	1, 415	20, 600	1, 236				
Striped bass					3, 385	237	4, 120	206				
Tautog					1, 100	72	1, 020	67				
Other fish					3, 150	78	2, 470	53				
Total					32, 118	1, 848	29, 070	1, 606				
Fyke nets:												
Catfish	1, 865	92	2, 050	102	9, 166	304	7, 835	260	5, 580	268	6, 000	289
Eels					10, 697	561	9, 143	480				
Flounders					66, 970	1, 674	57, 240	1, 431				
Perch	477	38	525	42					1, 627	130	1, 750	140
Striped bass	68	8	75	9	608	74	520	64	79	9	85	10
Suckers	455	25	500	28					2, 301	132	2, 475	142
Other fish	77	4	85	5	5, 950	175	5, 086	150	69	3	75	4
Total	2, 942	167	3, 235	186	93, 391	2, 788	79, 824	2, 385	9, 656	542	10, 385	585
Lines:												
Bluefish					20, 000	800	17, 500	700				
Catfish					3, 830	140	5, 120	200				
Cod					82, 000	3, 800	68, 750	3, 350				
Flounders					38, 860	1, 720	29, 372	1, 278				
Kingfish					4, 210	240	6, 430	325				
Sea bass					8, 000	400	7, 000	350				
Squeteague					143, 010	8, 000	127, 350	7, 120				
Striped bass					8, 725	840	9, 120	910				
Tautog					43, 500	2, 580	38, 735	2, 115				
Tomcod					5, 680	230	7, 040	283				
Other fish					2, 740	85	3, 285	100				
Total					369, 555	18, 835	319, 702	16, 731				
Spears:												
Eels					219, 383	13, 163	235, 316	14, 119				
Flounders					58, 117	3, 479	55, 100	3, 306				
Total					277, 500	16, 642	290, 416	17, 425				
Pots:												
Eels	375	26	575	40	196, 963	12, 075	176, 013	10, 825	850	59	750	53
Miscellaneous:												
Oysters					2,920,400	510,180	3,024,070	524,340				
Soft clams					500,000	33,770	553,000	37,735				
Quahogs					1,536,640	236,275	1,784,960	274,780				
Lobsters					6, 320	575	4,840	485				
Total					4,963,360	780,800	5,366,870	837,340				
Grand total	63, 262	3, 349	39, 466	2, 153	7,283,089	897,761	7,402,787	939,198	137, 646	3, 416	133, 203	3, 412

Statement by counties, apparatus, and species of the yield of the shore fisheries of New York—Continued.

Apparatus and species.	Richmond.				Rockland.				Suffolk.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Alewives									18,500	$340	12,600	$235
Bluefish									1,125,175	45,013	965,350	38,616
Eels									10,800	760	9,100	635
Flounders									22,000	865	14,750	710
Kingfish									93,666	5,500	72,501	4,350
Minnows									45,100	750	25,600	480
Mullet									142,000	7,100	122,500	6,100
Perch									10,500	850	9,250	810
Sea bass									207,745	10,387	196,180	9,809
Shad	28,000	$1,400	36,000	$1,800								
Spanish mack'l.									42,132	2,850	39,999	2,800
Squeteague	30,000	1,800	22,000	1,100					319,500	15,685	298,467	13,840
Striped bass									31,471	2,200	44,274	3,100
Tautog									2,000	130	1,800	110
Tomcod									150,000	6,000	117,500	4,700
Other fish									35,600	1,800	27,100	1,450
Total	58,000	3,200	58,000	2,900					2,256,189	100,230	1,956,971	87,745
Gill nets:												
Alewives									756,667	5,674	751,600	5,637
Bluefish									482,850	26,901	462,150	25,092
Perch					1,150	$104	985	$87				
Sea bass									85,937	7,208	75,041	6,617
Shad	24,000	1,260	34,000	1,700	286,800	14,340	284,000	14,200	100,540	5,036	88,219	6,174
Squeteague	26,000	1,300	13,600	680					361,754	16,302	323,774	16,373
Striped bass					1,000	120	775	103				
Sturgeon					750	30	900	36				
Suckers					875	70	650	52				
Other fish					600	47	515	45	44,580	2,239	37,727	1,839
Total	50,000	2,500	47,600	2,380	291,175	14,711	287,825	14,523	1,832,328	63,360	1,738,511	61,732
Pound nets:												
Alewives									14,484	420	17,898	347
Bluefish									61,206	2,680	58,190	2,501
Bonito									2,500	200	1,750	150
Butter-fish									114,007	3,800	222,297	13,452
Eels									24,174	1,121	21,008	980
Flounders									72,159	1,375	62,026	2,172
Kingfish									8,471	916	7,505	761
Menhaden									1,746,164	2,095	1,304,984	1,868
Scup									96,325	1,876	86,918	1,738
Sea bass									45,567	2,393	39,345	1,986
Shad									6,824	553	5,054	416
Sheepshead									6,649	1,130	5,467	980
Skates									28,777	546	28,537	566
Spanish mack'l.									6,286	988	9,415	1,270
Spot									6,114	244	4,901	196
Squeteague									481,199	15,076	465,146	14,504
Squid									11,420	456	11,436	457
Striped bass									14,057	1,827	12,700	1,650
Sturgeon									8,695	225	5,881	156
Tautog									19,553	781	20,422	816
Tomcod									860	42	800	42
Other fish									22,048	617	13,159	276
Refuse fish									365,298	876	286,829	716
Total									3,165,775	40,237	2,692,028	38,000
Fyke nets:												
Alewives	6,920	87	6,400	80					24,779	309	25,920	324
Bluefish									25,102	1,084	28,350	1,134
Butter-fish									41,299	619	43,200	648
Catfish	6,475	258	5,980	235	3,996	199	3,600	180	11,615	232	12,150	243
Eels	4,820	247	5,330	280					5,822	304	6,090	326
Flounders									942,287	23,208	986,700	24,277
Kingfish									253	38	265	40
Menhaden									619,488	774	648,000	810
Perch	2,230	90	1,980	80	1,970	157	1,775	142				
Scup									38,718	774	40,500	810
Sea bass									7,743	387	8,100	405
Shad	6,792	475	7,080	495	1,720	86	1,550	78				
Squeteague									103,248	3,097	108,000	3,240
Striped bass	1,742	205	1,525	183	1,831	217	1,650	196	1,577	191	1,650	200
Sturgeon					1,165	46	1,050	42				
Suckers					2,081	122	1,875	110				
Tautog									9,679	387	10,125	405
Tomcod									38,813	738	40,600	772
Other fish	4,000	120	3,235	97	832	49	750	45	26,156	576	27,360	603
Refuse fish									92,923	222	97,200	243
Total	32,979	1,482	31,530	1,450	13,595	876	12,250	793	1,989,502	32,940	2,084,210	34,474

Statement by counties, apparatus, and species of the yield of the shore fisheries of New York—Continued.

Apparatus and species.	Richmond. 1890. Pounds.	Richmond. 1890. Value.	Richmond. 1891. Pounds.	Richmond. 1891. Value.	Rockland. 1890. Pounds.	Rockland. 1890. Value.	Rockland. 1891. Pounds.	Rockland. 1891. Value.	Suffolk. 1890. Pounds.	Suffolk. 1890. Value.	Suffolk. 1891. Pounds.	Suffolk. 1891. Value.
Lines:												
Bluefish									90,240	$4,512	82,680	$4,312
Catfish	2,000	$90	2,530	$115					4,610	160	5,460	210
Cod									159,175	6,912	139,231	6,064
Flounders	8,625	300	7,780	275					45,685	1,367	38,920	1,180
Haddock									13,520	338	11,320	283
Kingfish									9,165	550	10,200	592
Perch	2,535	130	2,782	141					3,800	190	3,250	174
Sea bass									2,780	111	2,436	100
Squeteague	58,945	2,950	54,320	2,715					128,420	6,425	135,000	6,750
Striped bass	14,560	1,575	16,933	1,822					2,890	315	2,120	248
Tautog	3,415	170	3,000	150					38,995	1,554	32,400	1,295
Tomcod	2,130	68	3,200	100					8,415	245	9,380	280
Other fish	1,750	60	2,180	60					6,050	197	5,364	176
Total	93,960	5,343	92,725	5,378					513,745	22,876	477,761	21,664
Spears:												
Eels									272,106	15,428	268,100	16,629
Flounders									93,363	5,472	97,331	5,720
Total									365,469	20,900	365,431	22,349
Pots:												
Eels	22,500	1,350	20,833	1,250	2,285	$160	2,214	$155	709,849	42,383	689,416	40,840
Miscellaneous:												
Oysters	840,700	102,720	952,000	125,250					1,289,050	179,950	1,713,600	241,050
Soft clams	65,000	3,900	53,000	3,180					848,000	50,240	757,500	51,895
Quahogs	73,600	11,500	68,000	10,625					1,282,600	174,700	1,304,200	173,368
Lobsters	9,260	888	8,150	810					23,517	2,333	21,234	2,183
Crabs, hard									311,600	4,995	350,166	5,360
Crabs, soft									55,000	1,750	53,334	1,700
Total	988,560	119,008	1,081,150	139,865					3,809,767	413,968	4,200,034	475,556
Grand total	1,245,939	132,883	1,331,883	153,223	307,055	15,747	302,289	15,471	14,642,624	736,894	14,204,362	782,360

Apparatus and species.	Ulster. 1890. Lbs.	Ulster. 1890. Value.	Ulster. 1891. Lbs.	Ulster. 1891. Value.	Westchester. 1890. Lbs.	Westchester. 1890. Value	Westchester. 1891. Lbs.	Westchester. 1891. Value.	Total. 1890. Lbs.	Total. 1890. Value.	Total. 1891. Lbs.	Total. 1891. Value.
Seines:												
Alewives	172,233	$2,201	177,233	$2,260	115,267	$1,470	150,166	$1,914	1,183,499	$15,401	1,136,597	$14,615
Bluefish									1,445,050	59,541	1,230,495	50,228
Catfish	2,836	170	2,713	163					17,354	1,018	17,025	996
Eels									13,060	892	10,748	725
Flounders									23,200	925	15,650	750
Kingfish									153,449	9,699	124,318	7,759
Minnows									45,100	750	25,600	480
Mullet									182,600	9,033	160,060	7,878
Perch	1,742	105	1,191	71	11,200	896	10,200	816	44,439	3,051	41,808	2,901
Sea bass									269,105	15,886	248,614	12,715
Shad	151,600	7,580	90,600	4,530	118,400	5,920	103,200	5,160	480,742	24,124	332,085	16,748
Spanish mackerel									62,603	4,283	57,604	4,031
Squeteague									464,578	24,259	401,030	19,803
Striped bass					15,400	1,848	12,500	1,500	94,406	7,518	95,503	8,406
Tautog									2,000	130	1,800	110
Tomcod									215,200	9,016	179,150	7,166
Other fish	1,422	25	1,596	41	1,800	108	1,500	90	86,202	4,080	52,597	2,517
Total	329,833	10,081	273,333	7,065	262,067	10,242	277,566	9,480	4,782,587	189,606	4,130,684	157,828
Gill nets:												
Alewives									1,035,501	8,154	987,440	7,780
Bluefish									752,183	40,851	709,650	37,467
Perch	1,610	145	2,035	185	2,180	150	1,965	137	17,475	1,549	17,150	1,527
Sea bass									85,937	7,208	75,041	6,617
Shad	217,400	10,870	161,420	8,055	1,526,800	76,340	1,491,600	74,580	3,213,640	160,691	2,643,695	139,932
Squeteague									491,182	23,602	438,517	23,153
Striped bass	1,475	177	1,600	192	1,250	150	1,100	132	15,030	1,803	14,200	1,701
Sturgeon	1,250	50	1,050	42	850	34	950	38	7,670	306	7,560	302
Suckers	850	68	950	76	1,440	72	1,440	72	8,820	662	8,670	650
Other fish	765	69	1,315	120	1,157	80	1,085	73	58,202	3,305	51,357	2,885
Total	223,350	11,379	168,370	8,670	1,533,677	76,826	1,498,140	75,032	5,685,640	248,131	4,953,280	222,014

Statement by counties, apparatus, and species of the yield of the shore fisheries of New York—Continued.

Apparatus and species.	Ulster.				Westchester.				Total.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Pound nets:												
Alewives									14,484	$420	17,898	$347
Bluefish									82,206	3,580	61,190	2,651
Bonito									2,500	200	1,750	150
Butter-fish									119,007	4,000	234,797	3,952
Eels									24,174	1,121	21,008	980
Flounders									78,059	1,721	70,386	2,666
Kingfish									8,471	916	7,565	761
Menhaden									1,746,164	2,095	1,304,984	1,868
Scup									96,325	1,876	86,918	1,738
Sea bass									45,567	2,393	39,345	1,986
Shad									39,407	2,418	31,654	1,952
Sheepshead									6,649	1,130	5,467	980
Skates									28,777	546	28,537	566
Spanish mack'l.									6,286	988	9,415	1,270
Spot									6,114	244	4,901	196
Squeteague									485,924	15,426	468,896	14,804
Striped bass									17,440	2,064	16,820	1,856
Sturgeon									8,695	225	5,881	156
Tautog									20,653	853	21,442	883
Tomcod									800	42	800	42
Other fish									25,198	695	15,929	329
Refuse fish									365,298	876	286,829	716
Squid									11,420	456	11,436	457
Total									3,239,618	44,285	2,753,848	41,306
Fyke nets:												
Alewives									31,699	396	32,320	404
Bluefish									25,102	1,084	28,350	1,134
Butter-fish									41,299	619	43,200	648
Catfish	4,370	$209	4,600	$221	2,000	$100	2,450	$123	79,781	3,257	77,945	3,198
Eels									34,150	1,784	31,420	1,650
Flounders					15,000	750	10,000	500	1,036,340	25,962	1,064,180	26,488
Kingfish									253	38	265	40
Menhaden									619,488	774	648,000	810
Perch	1,757	140	1,850	148	1,275	102	1,050	84	21,427	1,472	20,555	1,453
Scup									38,718	774	40,500	810
Sea bass									7,743	387	8,100	405
Shad					950	48	800	40	37,026	2,331	32,790	2,073
Squeteague									109,112	3,380	112,970	3,480
Striped bass	80	9	85	10	7,250	870	6,100	732	18,559	2,271	16,305	2,000
Sturgeon					700	28	650	26	1,865	74	1,700	68
Suckers	997	64	1,050	68	1,600	64	1,900	76	16,149	873	16,708	895
Tautog					10,000	500	8,000	400	19,679	887	18,125	805
Tomcod					10,000	500	8,000	400	48,813	1,238	48,600	1,172
Other fish	142	8	150	9	300	18	275	16	45,196	1,176	43,649	1,127
Refuse fish									92,923	222	97,200	243
Total	7,346	430	7,735	456	49,075	2,980	39,225	2,397	2,325,322	48,999	2,382,882	48,903
Lines:												
Bluefish									114,860	5,543	105,680	5,287
Catfish					4,840	246	5,280	265	18,780	784	22,210	950
Cod									248,875	11,174	217,148	9,964
Flounders					19,470	960	21,365	995	120,780	4,585	107,737	4,033
Haddock									13,520	338	11,320	283
Kingfish									13,375	790	16,630	917
Perch					620	50	1,070	73	8,720	437	8,612	448
Sea bass									10,780	511	9,436	450
Squeteague									333,475	17,525	321,130	16,758
Striped bass					1,215	145	880	145	27,990	2,955	29,973	3,182
Tautog					2,300	110	2,040	100	89,340	4,472	77,005	3,705
Tomcod					26,802	1,340	29,000	1,375	43,827	1,919	49,850	2,088
Other fish					1,140	35	1,300	40	17,480	608	19,004	651
Total					56,387	2,886	60,935	2,953	1,061,802	51,641	995,735	48,716
Spears:												
Eels					5,000	500	3,500	350	519,306	30,460	524,000	32,123
Flounders									152,413	9,007	152,431	9,026
Total					5,000	500	3,500	350	671,719	39,467	676,431	41,149
Pots:												
Eels	975	58	875	52	31,000	3,100	30,000	3,000	999,017	61,290	957,331	58,441
Miscellaneous:												
Oysters					630,000	65,000	560,000	58,000	8,238,650	1,374,600	9,301,670	1,562,960
Soft clams					40,000	4,000	25,000	2,500	1 580,000	103,370	1,505,500	105,891
Quahogs					336,000	52,500	320,000	50,000	3,497,240	508,787	3,793,760	548,591
Lobsters					12,000	1,500	10,000	1,250	58,017	5,921	49,954	5,303
Crabs, hard									430,016	7,470	435,566	7,589
Crabs, soft									88,466	3,350	93,500	3,450
Total					1,018,000	123,000	915,000	111,750	13,892,389	2,003,498	15,179,950	2,233,784
Grand total	561,504	21,948	450,313	16,243	2,955,206	219,534	2,824,366	204,962	32,658,094	2,686,917	32,030,141	2,852,141

FISHERIES OF NEW JERSEY.

Importance and prominent features of industry.—The rank of New Jersey among the States of this section, as determined by the value of the products, is fourth, although the difference between it and Virginia is so slight that a comparatively unimportant advance in the catch of one of a dozen species would place this State ahead. Its position is only one point lower when the entire country is considered.

The natural features of this State are extremely favorable to the prosecution of extensive fisheries. The long ocean frontage permits the carrying on of various fisheries for the typical salt-water fishes, which are unusually abundant on this coast; the large bays of the northern and southern extremities of the State and the smaller bays on the ocean side afford uncommonly fine opportunities for oyster fishing and cultivation, in addition to being the haunts of numerous shore and anadromous fishes of recognized food value, while the two foremost shad rivers in the country skirt the borders of the State, the Delaware forming practically its entire western boundary and the Hudson its eastern border for a distance of 22 miles above its mouth.

Every part of the State is within easy rail communication with New York, Brooklyn, Philadelphia, Jersey City, Newark, Trenton, and other large cities of New York, Pennsylvania, and New Jersey, thus insuring a ready and constant market, while the enormous summer population of the seaside communities is in itself sufficient to maintain profitable fisheries of large proportions.

The specially prominent fisheries of this State are the taking of oysters and clams in lower New York, Delaware, and the smaller bays of the outer coast; the pound-net fishing on the northern part of the ocean shore; the line fishing for bluefish and sea bass carried on in the ocean from small boats; the gill-net and seine fishing for shad, alewives, and sturgeon in the Hudson and Delaware Rivers; the pound-net fishery for shad and other fishes along the shore west of Sandy Hook, and the menhaden industry. The fisheries in which New Jersey surpasses the other States of this region are the shore bluefish, the sea bass, the shad, the squeteague, and the king crab, and in the output of these same products the State takes precedence of the entire country.

Statistical summary.—In the following series of tables, condensed statistics of the fisheries of this State in 1889, 1890, 1891, and 1892 are presented.

The number of persons employed in the industry varied but little in the years named. In 1892, 10,447 persons were engaged, of whom 2,157 were vessel fishermen, 7,560 shore and boat fishermen, 194 transporters, and 536 shore employés, such as factory hands.

In the last year covered by the returns, $2,571,413 was represented by the vessels, boats, apparatus, shore property, and cash capital devoted to the business. The principal factors in this large amount were 540 fishing vessels, valued, with their outfits, at $718,060; 79 transporting vessels, worth $117,565; 5,591 boats, with a value of $414,321; 3,941 gill nets, worth $129,791; 234 pound nets, valued at $83,913; shore property and cash capital, $969,243. The investment in 1892 was larger than in any of the three preceding years, and was about $350,000 more than in 1889.

The yield of the fisheries in 1892 was 73,267,434 pounds, valued at $3,646,382. The quantity of the catch was less and the value was greater than in any of the other years. The decrease in the output was due chiefly to a diminished catch of bluefish and menhaden, while the augmented value of the yield depended chiefly on larger sales of market and seed oysters.

Persons employed in the fisheries of New Jersey.

Designation.	1889.	1890.	1891.	1892.
In vessel fisheries	1,871	1,893	2,017	2,157
In shore fisheries	7,783	7,822	7,889	7,560
On transporting vessels	169	181	201	194
On shore, in factories, etc	524	532	532	536
Total	10,347	10,428	10,639	10,447

Vessels, boats, shore property, and cash capital employed in the fisheries of New Jersey.

Designation.	1889.		1890.		1891.		1892.	
	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.
Vessels fishing	499	$490,880	500	$502,490	524	$541,520	540	$539,965
Tonnage	7,387		7,510		7,883		8,255	
Outfit		104,728		111,089		122,433		128,095
Vessels transporting	60	85,600	71	96,050	83	108,150	79	104,150
Tonnage	1,094		1,256		1,437		1,329	
Outfit		9,390		11,167		13,255		13,415
Boats	5,600	396,665	5,616	401,718	5,742	412,373	5,591	414,321
Apparatus—vessel fisheries:								
Seines	10	5,650	11	6,100	12	6,100	10	5,450
Lines and trawls		322		315		370		450
Pots, lobster and eel	200	199	341	365	270	245	235	210
Oyster dredges and tongs	1,427	34,712	1,453	35,917	1,533	38,990	1,603	40,398
Clam rakes and tongs	459	6,787	368	3,799	397	4,793	388	4,660
Crab dredges	24	96	60	240	102	468	92	402
Apparatus—shore fisheries:								
Seines	340	30,832	353	31,931	360	31,922	357	32,268
Gill nets	4,120	127,196	4,045	129,911	3,983	129,832	3,951	129,791
Pound nets and weirs	102	43,015	141	40,571	185	55,370	234	83,913
Fyke nets and bag nets	1,730	17,331	1,794	18,256	1,692	18,881	1,625	18,431
Pots, eel and lobster	4,100	4,811	4,036	4,824	4,485	5,094	4,335	4,518
Lines and trawls		4,359		4,189		4,808		4,358
Oyster tongs, rakes, and dredges	2,495	12,501	2,492	12,392	2,498	12,307	2,642	13,470
Clam tongs rakes, and hoes	2,077	11,368	2,155	11,625	2,160	11,652	2,217	12,996
Minor apparatus		894		903		891		909
Shore and accessory property		375,389		395,875		409,561		420,743
Cash capital		468,450		530,650		538,850		548,500
Total		2,231,155		2,350,377		2,467,865		2,571,413

Products of the fisheries of New Jersey.

Species.	1889.		1890.		1891.		1892.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Albacore	3,708	$94	3,796	$90	4,176	$100	6,410	$186
Alewives	3,328,235	33,829	1,860,740	14,453	2,066,820	14,260	1,985,555	14,361
Black bass	5,535	663	6,935	873	9,250	1,166	12,035	1,542
Bluefish	8,564,600	313,805	9,291,125	340,939	7,227,926	264,163	4,765,873	178,691
Bonito	177,850	6,411	144,750	5,144	150,633	9,857	105,643	4,000
Butter-fish	236,900	7,027	238,685	7,091	230,802	6,582	368,862	10,845
Carp	2,725	218	2,525	202	2,000	160	2,025	162
Catfish	214,423	12,892	157,325	9,735	133,824	8,265	144,938	8,877
Cero	956	42	630	26	847	38	3,610	172
Cod	981,535	26,284	729,747	19,164	841,011	26,001	676,859	20,691
Dogfish	36,000	90	60,000	150	77,000	190	56,000	140
Drum	22,683	671	26,900	726	124,240	980	39,650	892
Eels	570,180	37,357	579,438	37,309	623,280	38,594	565,210	36,283
Flounders	885,912	31,374	923,365	32,091	987,895	33,620	1,221,172	36,645
Frostfish or tomcod	3,000	90	4,500	135	1,400	42	2,000	60
Haddock	21,620	769	18,710	638	17,940	675	16,070	487
Hake	13,800	240	12,040	188	12,080	204	8,526	89
Kingfish	33,050	2,073	49,530	2,730	33,697	2,298	26,783	1,908
Mackerel	12,987	1,172	9,919	987	25,117	2,316	22,907	2,747
Menhaden	22,240,576	64,084	30,391,227	63,535	20,670,542	56,974	16,565,541	48,535
Mullet	48,670	1,860	92,400	5,131	88,350	4,902	43,500	2,458
Perch, white	198,104	13,491	215,278	15,261	193,724	13,539	182,887	12,636
Perch, yellow	463,379	24,796	488,524	26,291	500,238	27,219	394,332	21,767

Products of the fisheries of New Jersey—Continued.

Species.	1889.		1890.		1891.		1892.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Pike	19, 584	$1, 812	18. 940	$1, 859	19, 485	$1, 904	18, 880	$1, 811
Scup	12, 000	422	16, 220	630	25, 682	855	48, 150	1, 579
Sea bass	2, 968, 328	118, 658	3, 560, 419	139, 992	3, 731, 538	147, 693	3, 892. 311	153, 431
Shad	10, 423, 572	372, 543	10, 622, 719	409, 659	10, 225, 455	443, 438	8, 746, 518	582, 221
Sheepshead	59, 754	8, 508	23, 566	3, 772	26, 290	4, 013	37, 337	5, 461
Skates	7, 400	370	9, 300	465	7, 050	353	5. 700	286
Spanish mackerel	57, 232	9, 555	59, 050	9, 700	78, 391	12, 620	117, 254	15. 907
Spots and croakers	43, 260	1, 938	78, 010	3, 336	106, 680	4, 521	184, 182	7, 424
Squeteague or weakfish	4, 716, 330	138, 106	4, 073, 008	180, 465	6, 002, 563	201, 515	7, 540, 196	208, 051
Striped bass	305, 884	42, 610	328, 196	47, 645	298, 164	43, 296	219, 675	33, 395
Sturgeon	3, 592, 188	67, 498	455, 775	11, 868	452, 630	10, 619	448, 887	8, 829
Suckers	50, 843	3, 756	56, 546	3, 914	56, 680	4, 008	53, 430	3, 667
Tautog	84, 395	3, 696	89, 945	3, 654	99, 437	3, 894	93, 630	3, 723
Other fish	85, 411	2, 864	63, 622	3, 053	73, 217	3, 152	105, 122	3, 258
Crabs, soft	299, 700	31, 805	275 500	31, 675	289, 500	35, 380	409, 520	37, 642
Crabs, hard	53, 866	2, 004	142, 333	5, 317	230, 111	9, 499	164, 433	7, 267
Crabs, king	1, 974, 188	6, 162	3, 335, 700	8, 573	2, 798, 980	7, 534	2, 025, 460	5, 369
Lobsters	188, 347	14, 301	185, 321	13, 683	165, 664	12, 463	143, 905	10, 861
Shrimp	....	....	1, 050	525	1, 200	600	750	500
Mussels	....	....	....	....	6, 000	200	....	....
Oysters, market	7, 457, 408	1, 060, 182	7, 956, 515	1, 218, 792	7, 686, 322	1, 227, 909	8, 047, 151	1, 270, 568
Oysters, seed	7, 706, 965	356, 510	7, 856, 030	375, 388	8, 428, 245	411, 739	10. 157, 140	496, 060
Quahogs or hard clams	3, 414, 192	311, 601	3, 396, 364	342, 637	3, 454, 024	371, 933	2, 990, 572	349, 221
Clams, soft or long	772. 110	44, 660	815, 270	47, 090	827, 000	47, 700	595. 450	34, 620
Terrapins	2, 250	683	2, 560	770	3, 280	1, 074	2, 598	997
Turtles	....	....	....	....	....	....	2, 795	60
Total	82, 361, 635	3, 170, 376	88, 730, 048	3, 447, 351	79, 116, 380	3, 520, 057	73, 267, 434	3, 646, 382

The molluscan and crustacean products shown in the preceding table, which are usually designated by a different unit than pounds, are separately shown by number or bushels in the following table:

Species.		1889.	1890.	1891.	1892.
Crabs, soft	number..	899, 100	826, 500	868, 500	1, 228, 560
Crabs, hard	do....	161, 598	426, 999	690, 333	493, 299
Crabs, king	do....	987, 094	1, 667, 850	1, 399, 490	1, 012, 730
Oysters, market	bushels..	1, 065, 344	1, 136, 645	1, 098, 046	1, 149, 593
Oysters, seed	do....	1, 100, 995	1, 122, 290	1, 204, 035	1, 451, 020
Quahogs or hard clams	do....	426, 774	424, 546	431, 753	373, 822
Clams, soft or long	do....	77, 211	81, 527	82, 700	59, 545
Mussels	do....	....	....	600	....

Statistics of the fisheries by counties.—Commercial fishing is carried on in 17 counties in this State bordering on the ocean, the bays tributary thereto, and the Delaware and Hudson rivers. Seven of these, viz, Atlantic, Burlington, Cape May, Cumberland, Middlesex, Monmouth, and Ocean abut on salt water, and several others have vessels which follow fishing for salt-water species. The counties named are those maintaining the most important fisheries.*

The preeminent county of New Jersey, viewed from the fishing standpoint, is Cumberland. More persons are there employed, a greater amount of money is invested, and the value of the products is more than in any other county. The importance of the fisheries of this county is due entirely to the oyster industry, as the business of taking other products is insignificant. In 1892, 2,005 persons were employed in the fisheries of this county; of these 1,481 were vessel fishermen, 245 shore fishermen, and 279 shore employés. The capital invested was $872,570. The principal items entering into this investment were 336 vessels, valued at $454,363, a much larger number than was found in the remainder of the State; 133 boats, valued at $15,335; 1,412 oyster dredges and tongs, with a value of $33,890; and $362,371 representing shore property

* In 1892 a large amount of fishing is shown in Ocean County which was credited to Burlington County in previous years. In the year named the county line of Burlington County was moved south, throwing a considerable part of that county into Ocean County.

and working capital. The value of the products was $1,006,232. Of this sum the oyster yield constituted $963,755. The only other objects worthy of mention were shad, worth $33,457, and sturgeon, worth $7,310.

Next in importance to Cumberland is Monmouth County, which has varied fishing interests, and in respect to its food-fish fisheries is one of the most prominent sections on the Atlantic seaboard. It has a frontage on the ocean and also on Sandy Hook Bay, and includes all that part of the New Jersey coast north of Manasquan and east of Keyport. In the years 1890 and 1891 the number of fishermen and value of the catch were greater than in any other county. In 1892, 1,981 persons were employed, of whom 1,534 were shore fishermen. The decrease of over 400 persons, as compared with the previous year, was almost entirely due to the very disastrous fire which visited Seabright, the principal fishing center, in the latter part of 1891, causing many line fishermen to leave that community and seek employment elsewhere or engage in other occupations. The aggregate investment was $572,003. Vessels to the number of 132 were operated; these were valued at $147,465. The 1,119 small boats used had a value of $67,640. The most valuable apparatus employed were pound nets, 48 of which were worth $67,540. All other apparatus had a value of only $34,538.

The catch in Monmouth County consisted of a large variety of water products. Oysters had a value of $226,864, hard clams $183,671, bluefish $130,653, squeteague $103,049, sea bass $61,034, crabs $37,308, soft clams $32,780, menhaden $30,762, and other products $105,732, the whole being worth $911,853 to the fishermen. In 1890 and 1891 the fishermen received $1,059,229 and $1,092,440, respectively, for their catch. The decline indicated from 1891 to 1892 was due principally to the smaller number of fishermen engaged in line fishing, and was made up largely of bluefish and sea bass; there was also, however, a diminished yield of menhaden, oysters, and soft clams, while the catch of squeteague was much larger.

Each of the counties of Atlantic, Ocean, and Salem has over 1,000 persons engaged in the fishing industry, over $180,000 invested, and products worth over $250,000. Burlington, Camden, and Cape May counties also have important fisheries.

The following tables, relating to the years 1890, 1891, and 1892, present detailed statistics for each county:

Statement by counties of the number of persons employed in the fisheries of New Jersey.

Counties.	In vessel fisheries.			In shore fisheries.			On transporting vessels.			On shore, in factories, etc.			Total.		
	1890.	1891.	1892.	1890.	1891.	1892.	1890.	1891.	1892.	1890.	1891.	1892.	1890.	1891.	1892.
Atlantic	79	77	90	1,013	1,035	967	43	46	42	61	62	61	1,196	1,220	1,160
Bergen	......	......	......	121	112	114	......	......	......	......	......	......	121	112	114
Burlington	30	43	......	917	911	630	17	19	2	31	43	12	995	1,016	644
Camden	149	160	164	170	174	173	15	12	15	......	......	......	334	346	352
Cape May	63	69	83	587	672	734	16	18	19	8	8	10	674	767	846
Cumberland	1,269	1,357	1,481	187	201	245	......	......	......	239	260	279	1,695	1,818	2,005
Essex	......	......	......	......	......	......	......	......	......	25	26	26	25	26	26
Gloucester	5	......	5	174	170	167	......	......	......	......	......	......	179	170	172
Hudson	10	8	8	182	185	181	2	4	4	5	5	6	199	202	199
Hunterdon and Warren	......	......	......	81	81	78	......	......	......	......	......	......	81	81	78
Mercer	......	......	......	53	49	50	......	......	......	......	......	......	53	49	50
Middlesex	5	2	......	282	266	279	16	16	16	......	......	......	303	284	295
Monmouth	270	287	278	1,958	1,942	1,534	54	72	61	151	116	108	2,433	2,417	1,981
Ocean	13	14	48	682	694	998	18	14	35	6	6	30	719	728	1,111
Salem	......	......	......	1,305	1,307	1,309	......	......	......	......	......	......	1,305	1,307	1,309
Union	......	......	......	110	90	101	......	......	......	6	6	4	116	96	105
Total	1,893	2,017	2,157	7,822	7,889	7,560	181	201	194	532	532	536	10,428	10,639	10,447

Statement by counties of the apparatus and capital employed in the fisheries of New Jersey.

Designation.	Atlantic.						Bergen.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	24	$27,400	24	$24,600	25	$37,050						
Tonnage	297		289		325							
Outfit		5,931		6,360		6,739						
Vessels transporting	17	27,800	13	30,000	17	24,350						
Tonnage	442		454		393							
Outfit		2,850		3,045		2,978						
Boats	935	57,259	984	62,083	967	61,421	102	$4,560	90	$4,000	92	$4,080
Apparatus—vessel fisheries:												
Seines	2	1,500	2	1,500	2	1,500						
Lines		205		275		360						
Oyster dredges and tongs	46	804	30	558	44	702						
Clam rakes and tongs	22	118	23	124	19	103						
Apparatus—shore fisheries:												
Seines	66	3,135	71	3,268	62	3,355						
Gill nets	60	202	60	202	46	142	1,283	8,855	1,181	8,278	1,179	8,218
Fyke nets and bag nets	26	456	29	546	29	546						
Pots, lobster and eel							100	200	120	240	120	240
Lines		1,315		1,363		1,163						
Oyster tongs, rakes, and dredges	360	1,517	383	1,620	431	1,865						
Clam tongs, rakes, and hoes	482	1,874	492	1,909	503	1,944						
Minor apparatus		4		4								
Shore property		30,460		31,455		30,960		5,255		4,780		4,760
Cash capital		62,400		65,400		68,400						
Total		225,230		234,312		243,578		18,870		17,298		17,298

Designation.	Burlington.						Camden.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	3	$16,500	4	$23,500			30	$42,700	31	$47,300	30	$49,150
Tonnage	87		151				636		688		689	
Outfit		3,715		4,475				9,360		9,845		10,325
Vessels transporting	7	7,300	8	8,800	1	$350	5	5,550	4	3,850	5	5,300
Tonnage	110		134		13		78		56		76	
Outfit		1,070		995		20		515		400		500
Boats	739	34,550	743	35,930	401	17,915	47	6,990	49	7,385	48	7,350
Apparatus—vessel fisheries:												
Seines	2	1,200	3	1,700								
Lines								5				
Oyster dredges and tongs	3	12	3	12			114	2,800	123	3,050	117	2,925
Apparatus—shore fisheries:												
Seines	35	6,100	36	5,930	31	5,150	4	3,300	4	3,250	4	3,300
Gill nets	141	9,414	142	8,925	149	8,937	35	4,150	37	4,550	37	4,475
Fyke nets and bag nets	1,282	8,185	1,168	7,935	1,090	7,595						
Pots, lobster and eel	315	158	315	158	18	9						
Lines		441		419		407						
Oyster tongs, rakes, and dredges	318	1,141	328	1,177	76	228						
Clam tongs, rakes, and hoes	373	1,516	375	1,524	76	304						
Minor apparatus		35		35								
Shore property		25,735		31,435		8,025		1,265		1,270		1,265
Cash capital		26,000		28,500		4,000						
Total		143,072		161,450		52,940		76,635		80,900		84,590

Designation.	Essex.						Gloucester.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value
Vessels fishing							1	$1,000			1	$1,000
Tonnage							25				25	
Outfit								260				135
Boats							85	10,775	83	$10,435	82	10,540
Apparatus—vessel fisheries:												
Oyster dredges and tongs							4	100			4	100
Apparatus—shore fisheries:												
Seines							1	300	1	275	1	250
Gill nets							83	9,325	81	9,300	80	9,125
Shore property		$17,400		$17,500		$17,500		917		917		917
Cash capital		16,000		15,000		13,500						
Total		33,400		32,500		31,000		22,677		20,927		22,067

Statement by counties of the apparatus and capital employed in the fisheries of New Jersey—Continued.

Designation.	Cape May.						Cumberland.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	22	$18,350	24	$18,950	28	$23,550	303	$315,415	323	$334,145	336	$368,240
Tonnage	248		284		344		5,045		5,333		5,597	
Outfit		3,125		3,070		3,900		74,747		78,607		86,123
Vessels transporting	16	6,300	7	8,700	7	8,900						
Tonnage	38		154		153							
Outfit		415		555		575						
Boats	521	11,123	548	12,800	585	14,636	98	12,168	106	12,715	133	15,335
Apparatus—vessel fisheries:												
Lines		38		35		25		15				15
Pots, lobster and eel	35	35	70	70	35	35						
Oyster dredges and tongs	60	1,575	68	1,725	84	2,125	1,175	29,146	1,257	31,281	1,304	32,291
Apparatus—shore fisheries:												
Seines	105	3,465	105	3,445	112	3,610	1	200	1	190	1	175
Gill nets	17	770	33	1,465	47	2,270	59	6,075	62	6,375	61	6,395
Pound nets	102	3,081	140	3,640	174	6,003	4	40	4	40	7	70
Fyke nets and bag nets	3	150	3	150	3	150						
Pots, lobster and eel					40	30						
Lines		243		830		666						
Oyster tongs, rakes, and dredges	136	247	143	262	149	271	54	790	64	855	108	1,555
Clam tongs, rakes, and hoes	222	923	184	719	257	2,130						
Minor apparatus		134		133		150						
Shore property		19,265		19,285		22,410		127,717		132,832		139,871
Cash capital		27,800		25,000		28,000		191,500		211,500		222,500
Total		97,639		100,834		119,526		757,813		808,540		872,570

Designation.	Hudson.						Hunterdon and Warren.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	5	$7,000	4	$5,800	4	$5,800						
Tonnage	68		56		56							
Outfit		635		500		480						
Vessels transporting	1	700	2	1,900	2	1,900						
Tonnage	6		18		18							
Outfit		50		200		200						
Boats	96	4,695	99	4,770	98	4,490	40	$1,380	41	$1,385	34	$1,375
Apparatus—vessel fisheries:												
Pots, lobster and eel	200	175	200	175	200	175						
Oyster dredges and tongs	8	140	6	100	6	100						
Apparatus—shore fisheries:												
Seines			1	59	1	50	21	4,020	20	4,190	20	4,140
Gill nets	700	6,000	700	6,000	630	5,400						
Fyke nets and bag nets	210	3,750	210	3,750	210	3,750						
Pots, lobster and eel	80	80	75	75	75	75						
Oyster tongs, rakes, and dredges	65	325	68	340	70	350						
Shore property		3,765		3,765		3,765		890		875		850
Total		27,315		27,425		26,535		6,290		6,450		6,365

Designation.	Mercer.						Middlesex.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing							2	$1,100	1	$300		
Tonnage							16		7			
Outfit								350		130		
Vessels transporting							6	8,700	6	8,000	6	$8,000
Tonnage							83		86		86	
Outfit								930		930		930
Boats	35	$1,230	33	$1,220	31	$1,195	263	17,890	259	17,430	261	17,505
Apparatus—vessel fisheries:												
Pots, lobster and eel							100	150				
Clam rakes and tongs							4	50	4	50		
Apparatus—shore fisheries:												
Seines	8	1,475	8	1,550	8	1,525	4	2,500	4	2,500	5	2,900
Gill nets	19	1,090	21	1,290	19	1,120	50	1,000	50	1,000	50	1,000
Pound nets									1	500	1	500
Fyke nets and bag nets							20	610	22	990	17	800
Pots, lobster and eel							10	25	10	25	10	25
Oyster tongs, rakes, and dredges							513	3,078	496	2,976	502	3,012
Clam tongs, rakes, and hoes							8	80	10	100	7	70
Shore property		475		485		445		20,550		20,400		14,250
Cash capital								25,800		25,300		20,800
Total		4,270		4,545		4,285		82,813		80,631		69,852

Statement by counties of the apparatus and capital employed in the fisheries of New Jersey—Continued.

Designation.	Monmouth.						Ocean.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	104	$70,275	108	$85,475	107	$87,225	6	$2,750	5	$1,450	9	$17,950
Tonnage	1,040		1,053		1,075		48		32		144	
Outfit		12,630		18,776		15,488		336		670		4,815
Vessels transporting	20	31,450	31	40,200	25	38,500	9	7,650	7	6,700	16	16,850
Tonnage	307		454		379		95		83		212	
Outfit		4,787		6,690		6,252		550		440		1,960
Boats	1,326	77,503	1,335	80,147	1,119	67,640	689	71,130	705	70,448	1,075	98,329
Apparatus—vessel fisheries:												
Seines	7	3,400	7	2,900	6	2,850					2	1,100
Lines		43		60		50		9				
Pots, lobster and eel	6	5										
Oyster dredges and tongs	43	1,340	46	2,264	39	2,137					5	18
Clam rakes and tongs	326	3,619	356	4,608	349	4,541	16	12	14	11	20	16
Crab dredges	60	240	102	468	92	402						
Apparatus—shore fisheries:												
Seines	22	867	25	760	23	673	81	4,704	79	4,614	84	5,240
Gill nets	778	6,510	750	7,120	721	6,887	220	6,920	264	5,857	341	6,867
Pound nets	35	37,450	40	51,190	48	67,540					4	9,800
Fyke nets and bag nets	193	3,455	213	4,430	202	3,955	60	1,650	47	1,080	74	1,635
Pots, lobster and eel	1,991	3,398	2,020	3,505	1,712	2,906	1,540	963	1,945	1,091	2,360	1,233
Lines		1,174		1,150		1,023		1,016		1,046		1,099
Oyster tongs, rakes, and dredges	595	3,072	581	2,982	565	2,882	321	1,312	325	1,325	621	2,467
Clam tongs, rakes, and hoes	683	5,731	688	5,774	692	5,792	363	1,297	387	1,422	657	2,540
Minor apparatus		450		433		440		280		286		319
Shore property		98,723		100,472		104,520		18,568		18,765		47,355
Cash capital		167,150		153,650		150,300		11,000		12,000		39,500
Total		533,272		573,054		572,003		130,147		127,205		259,093

Designation.	Salem.						Union.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Boats	575	$87,215	612	$88,875	605	$89,450	65	$3,250	55	$2,750	60	$3,000
Apparatus—shore fisheries:												
Seines	5	1,865	5	1,900	5	1,900						
Gill nets	600	69,600	602	69,470	591	68,955						
Oyster tongs, rakes, and dredges							130	910	110	770	120	840
Clam tongs, rakes, and hoes							24	204	24	204	25	216
Shore property		22,490		22,925		22,850		2,400		2,400		1,000
Cash capital								3,000		2,500		1,500
Total		181,170		183,170		183,155		9,764		8,624		6,556

Designation.	Total for State.					
	1890.		1891.		1892.	
	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	500	$502,490	524	$541,520	540	$589,965
Tonnage	7,510		7,883		8,255	
Outfit		111,089		122,433		128,095
Vessels transporting	71	96,050	83	108,150	79	104,150
Tonnage	1,256		1,437		1,329	
Outfit		11,167		13,255		13,415
Boats	5,616	401,718	5,742	412,373	5,591	414,321
Apparatus—vessel fisheries:						
Seines	11	6,100	12	6,100	10	5,450
Lines		315		370		450
Pots, lobster and eel	341	365	270	245	235	210
Oyster dredges and tongs	1,453	35,917	1,533	38,990	1,603	40,398
Clam rakes and tongs	368	3,799	397	4,793	388	4,660
Crab dredges	60	240	102	468	92	402
Apparatus—shore fisheries:						
Seines	353	31,931	360	31,922	357	32,268
Gill nets	4,045	129,911	3,983	129,832	3,951	129,791
Pound nets	141	40,571	185	55,370	234	83,913
Fyke nets and bag nets	1,794	18,256	1,692	18,881	1,625	18,431
Pots, lobster and eel	4,036	4,824	4,485	5,094	4,335	4,518
Lines		4,189		4,808		4,358
Oyster tongs, rakes, and dredges	2,492	12,392	2,498	12,307	2,642	13,470
Clam tongs, rakes, and hoes	2,155	11,625	2,160	11,652	2,217	12,996
Minor apparatus		903		891		909
Shore property		395,875		409,561		420,743
Cash capital		530,650		538,850		548,500
Total		2,350,377		2,467,865		2,571,413

Statement by counties of the product of the fisheries of New Jersey.

Species.	Atlantic.						Bergen.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives	30,180	$617	34,980	$690	25,880	$497						
Bluefish	92,400	5,705	92,700	5,640	96,000	5,485						
Cod	66,660	1,460	83,500	2,890	79,000	3,600						
Drum	7,500	112	11,000	145	3,500	52						
Eels	10,000	500	9,000	450	4,200	210	10,000	$800	12,000	$960	12,800	$1,025
Flounders	77,900	2,857	79,800	3,500	62,900	2,097						
Kingfish	11,000	580	10,000	540	5,200	352						
Menhaden	4,371,500	9,109	2,424,000	5,051	1,818,000	4,543	20,800	62	25,000	75	25,000	75
Perch, white	54,500	3,695	46,700	2,916	40,500	2,230						
Pike	635	50	600	48	500	40						
Sea bass	63,200	3,165	53,000	2,660	56,100	2,411						
Shad	800	57	760	56	1,360	81	459,200	18,040	391,200	16,764	425,600	20,560
Sheepshead	5,700	870	3,200	420	2,500	250						
Spots and croakers	14,000	582	34,000	1,385	92,500	3,830						
Squeteague	1,618,800	74,890	1,640,100	76,839	1,201,125	54,115						
Striped bass	21,300	3,839	20,600	2,760	16,700	2,504	31,500	3,780	27,000	3,240	25,300	3,035
Tautog	2,500	125	2,000	100	1,000	50						
Other fish	6,000	300	7,700	385	6,000	300						
Oysters, market	731,514	127,250	720,412	123,565	813,750	134,978						
Oysters, seed	518,560	19,186	600,950	20,095	759,395	24,938						
Quahogs or hard clams	601,904	58,242	552,104	56,128	454,520	50,330						
Terrapins	1,510	395	1,340	366	1,200	308						
Total	8,308,063	313,586	6,428,446	306,629	5,541,830	293,201	521,500	22,682	455,200	21,039	488,700	24,695

Species.	Cape May.						Cumberland.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives	84,200	$938	66,400	$735	71,680	$828	17,350	$173	16,500	$165	15,400	$154
Bluefish	228,400	12,302	130,500	6,927	267,700	13,415						
Butter-fish	35,200	1,276	14,100	613	23,000	810						
Bonito	1,000	50	2,000	100	2,000	100						
Catfish	1,000	80	1,000	80	500	40	2,099	126	2,183	131	1,600	96
Cod			10,000	360	46,000	2,760						
Drum	16,900	514	24,200	647	33,250	742						
Eels	74,950	4,614	80,450	4,757	79,150	4,772						
Flounders	72,400	3,509	73,100	3,419	81,600	3,954						
Kingfish	34,200	1,680	18,800	1,174	17,800	1,073						
Menhaden	191,900	794	224,500	1,620	161,750	1,179						
Mullet	91,900	5,111	87,700	4,876	42,900	2,435						
Perch, white	26,700	2,229	20,400	1,686	14,115	1,182	2,116	127	1,800	108	2,350	141
Perch, yellow	500	25	500	25	100	5	3,332	200	4,186	251	3,500	210
Pike	4,000	480	3,500	420	2,000	240	175	17	200	20	150	15
Scup	5,500	280	9,500	395	10,000	400						
Sea bass	614,800	24,417	1,015,400	40,671	1,896,000	75,950	9,000	360			10,000	300
Shad	4,300	343	3,650	282	1,700	137	569,912	19,752	600,400	24,161	491,300	33,457
Sheepshead	2,300	545	100	15								
Spanish mackerel			200	20	700	70						
Spots and croakers	53,600	2,414	63,200	2,768	83,000	3,356						
Squeteague	729,500	26,730	655,500	24,520	449,350	18,957						
Striped bass	84,030	8,323	60,750	5,963	33,910	3,692	2,016	235	1 683	195	2,333	275
Sturgeon					12,750	255	438,350	11,233	428 700	9,562	390,125	7,310
Suckers							400	22	250	15	150	9
Tautog	4,600	400	5,500	440	4,000	320						
Other fish	1,500	60	1,200	48	1,000	40						
Crabs, hard	33,200	2,325	38,000	2,625	40,000	2,700						
King crabs	3,094,100	7,781	2,552,600	6,719	1,810,460	4,728	241,600	792	226,380	690	194,000	510
Oysters, market	383,250	60,023	351,225	58,631	413 385	67,136	3,971,688	575,583	3,706,871	579,526	4,210,255	653,015
Oysters, seed	173,600	8,805	186,550	9,583	285,600	14,625	4,635,918	209,583	5,156,970	240,881	6,386,380	310,740
Quahogs or hard clams	212,800	16,510	293,600	20,816	395,200	25,256						
Total	6,260,330	192,558	5,994,125	200,935	6,280,600	251,157	9.893,956	818,203	10,146,123	855,705	11,707,543	1,006,232

Statement by counties of the product of the fisheries of New Jersey—Continued.

Species.	Burlington.						Camden.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives	715,710	$3,943	697,590	$3,869	657,675	$3,629	126,200	$1,262	118,400	$1,184	110,320	$1,103
Black bass	6,935	873	9,250	1,166	12,035	1,542						
Bluefish	4,200	175	3,500	145			800	40				
Butter-fish	2,900	65	2,950	67								
Carp	2,525	202	2,000	160	2,025	162						
Catfish	51,500	3,717	49,215	3,566	45,775	3,334						
Drum			87,240	116								
Eels	57,165	3,446	53,830	3,186	29,680	1,998						
Flounders	24,520	1,046	22,500	965	4,900	245						
Kingfish	900	42	800	38	500	25						
Menhaden	7,090,600	10,655	4,739,160	7,783								
Perch, white	67,630	5,306	69,450	5,446	69,795	5,531						
Perch, yellow	15,800	1,249	12,480	998	13,025	1,042						
Pike	4,850	422	5,300	458	5,900	518						
Sea bass	7,200	300	6,900	290			3,700	148				
Shad	569,049	31,273	537,586	29,668	475,437	26,292	685,650	32,892	645,400	32,916	638,050	43,838
Sheepshead	1,200	120	600	60								
Spots and croakers	1,000	50	1,000	50	506	25						
Squeteague	274,000	10,445	201,500	8,900	13,000	620	4,500	135				
Striped bass	56,575	10,010	46,885	8,221	39,110	7,235	2,000	240	2,124	255	1,000	120
Suckers	47,025	3,503	49,100	3,660	45,460	3,358						
Other fish	22,250	1,414	22,950	1,442	20,005	1,255						
Oysters, market	274,295	28,502	279,524	29,288	71,050	6,598	363,398	52,990	395,738	61,670	469,350	73,625
Oysters, seed	364,042	11,626	359,800	10,974	126,000	3,600	488,600	22,130	570,500	28,050	658,700	32,970
Quahogs or hard clams	798,104	79,810	764,400	76,442	98,800	9,880						
Total	10,459,975	208,194	8,025,510	196,958	1,730,672	76,889	1,674,848	109,837	1,732,162	124,075	1,877,420	151,656

Species.	Hunterdon and Warren.						Mercer.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives	29,000	$290	31,500	$315	29,200	$292	8,000	$83	7,650	$80	7,500	$75
Catfish	20,861	1,170	19,606	1,072	17,963	990	2,565	120	2,420	112	1,850	95
Perch, white	2,932	185	2,805	178	2,242	146	800	50	710	45	985	60
Perch, yellow	4,862	273	4,732	286	4,387	252	1,130	45	1,340	54	1,070	43
Pike	2,360	210	2,770	245	2,450	220	520	40	415	35	680	58
Shad	57,828	5,373	58,100	5,354	52,090	4,719	60,164	4,973	45,831	3,775	38,218	2,682
Striped bass	1,820	182	2,095	211	1,840	185	610	60	763	75	460	45
Suckers	3,150	78	2,730	80	4,120	100						
Other fish	7,032	428	6,750	449	7,461	476	4,220	197	2,890	139	3,825	169
Total	129,845	8,189	131,088	8,190	121,753	7,380	78,009	5,568	62,019	4,315	54,588	3,227

Species.	Gloucester.						Hudson.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives	55,786	$186	80,858	$267	58,288	$197	1,000	$15	800	$12	900	$13
Catfish	10,071	604	7,200	432	9,428	566						
Eels							7,050	353	6,600	330	6,000	300
Menhaden									25,000	500	16,000	320
Perch, white	4,356	261	3,786	227	8,428	206	2,400	48	2,459	49	2,300	46
Perch, yellow	12,914	774	11,500	690	10,714	643						
Pike	171	17	171	18	114	11						
Shad	667,258	26,388	640,330	28,762	697,993	51,089	526,000	22,425	444,000	20,960	382,000	21,600
Striped bass	3,456	405	3,100	359	2,080	240	2,800	140	2,700	135	2,500	125
Suckers	514	31	328	19	214	13						
Other fish	100	5	71	3	86	4						
Lobsters							51,500	3,075	55,400	3,478	49,800	3,186
Oysters, market	8,400	900					117,600	18,300	87,500	13,900	84,000	13,200
Oysters, seed	17,500	875			17,500	875	247,800	17,700	245,000	17,500	210,000	15,000
Total	780,526	30,446	747,344	30,777	799,845	53,844	956,150	62,056	869,459	56,864	753,500	53,790

Statement by counties of the product of the fisheries of New Jersey—Continued.

Species.	Middlesex.						Monmouth.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Albacore							1,296	$40	2,176	$60	1,810	$54
Alewives							58,500	933	57,800	931	53,000	830
Bluefish	19,500	$780	7,000	$350	3,000	$171	7,519,525	270,059	6,076,926	213,499	3,714,023	130,653
Butter-fish							196,385	5,623	209,152	5,754	267,762	7,620
Bonito							108,150	4,020	122,733	4,721	71,443	2,802
Cero							630	26	847	38	1,910	98
Cod							638,087	16,704	737,511	22,351	546,859	14,131
Dogfish							60,000	150	77,000	190	56,000	140
Drum											900	18
Eels	800	80	500	50	200	20	234,823	16,091	279,200	17,886	235,130	15,588
Flounders	4,900	239	6,000	285	23,000	1,075	633,445	20,188	649,095	19,683	815,472	19,805
Haddock							11,210	338	12,940	475	13,570	387
Hake							12,040	188	12,080	204	8,526	89
Kingfish							1,430	206	2,747	368	2,183	301
Mackerel							9,819	975	25,017	2,304	18.607	2,105
Menhaden	1,458,333	2,625	1,641,666	3,435	2,179,166	3,983	17,128,894	39,560	11,457,716	37,708	8,273,425	30,762
Perch, white	5,500	330					6,800	426	8,600	514	5,800	350
Scup							10,120	326	15,582	436	23,250	618
Sea bass							2,244,019	86,707	2,364,538	91,944	1,618,286	61,034
Shad	30,500	1,355	28,400	1,155	21,500	995	159,810	9,265	159,118	9,952	159,963	10,298
Sheepshead							9,366	1,405	17,340	2,649	23,223	3,310
Skates							9,300	465	7.050	353	5,700	286
Spanish mackerel							47,275	6,998	63,691	9,115	98,454	12,517
Spots and croakers							7,610	230	7,580	286	6,982	164
Squeteague	8,550	513	9,000	540	3,500	210	1,048,958	52,779	3,202,463	78,288	4,966.521	103,049
Striped bass	12,700	1,116	8,900	712	2,200	176	18,950	2,287	20,150	2,159	14,750	1,464
Sturgeon							17,425	635	23,930	1,057	40,812	1,004
Tautog							77,745	2,948	87,037	3,181	82,030	3,127
Other fish	3,500	175	500	25	300	18	14,320	350	27,177	548	61,481	852
Crabs, hard							109,133	2,992	192,111	6,874	124.433	4,567
Crabs, soft							225,500	26,125	241,100	29,900	365,400	32,610
King crabs									20,000	125	21,000	131
Lobsters	11,250	600					114,571	9,368	105,264	8,585	91,105	7,435
Mussels									6,000	200		
Oysters, market	281,400	47,838	239,400	40,698	256,900	43,673	1,508,010	268,194	1,616,377	284,905	1,277,759	225,764
Oysters, seed	283,500	20,250	301,000	21,500	285,600	20,400	100,800	7.200	21,700	1,550	15,400	1,100
Clams, soft							790,270	45,090	803,000	45,780	572,450	32,780
Quahogs or hard clams	6,400	643	13,440	1,794	2,400	225	1,499,952	160,338	1,538,224	187,549	1,249,248	183,671
Terrapins									848	318	320	304
Turtles											1,545	35
Total	2,126,833	76,544	2,255,806	70,544	2,777,766	70,946	34,634,168	1,059,229	30,271,820	1,092,440	24,906,532	911,853

Species.	Salem.						Union.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives	334,714	$1,114	485,142	$1.598	349,712	$1,163						
Catfish	60,429	3,626	43,200	2,592	56,572	3,394						
Perch, white	26,144	1,569	22,714	1,363	20,572	1,234						
Perch, yellow	77,486	4,650	69.000	4,140	64,286	3,857						
Pike	1,029	103	1,029	110	686	69						
Shad	6,832,248	237,523	6,670,680	269,633	5,351,707	365,743						
Striped bass	13,039	1,505	12,314	1,401	13,742	1,595						
Suckers	3,057	184	1,972	119	1.286	77						
Other fish	600	30	429	22	514	26						
Oysters, seed							595,000	$42,500	525,000	$45,000	420,000	$36,000
Quahogs or hard clams							14,000	1,750	14,400	1,800	16,000	2,000
Total	7,348,746	250,304	7,306,480	280,978	5,859,077	377,158	609,000	44,250	539,400	46,800	436,000	38,000

Statement by counties of the product of the fisheries of New Jersey—Continued.

Species.	Ocean.						Total for State.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value	Pounds.	Value.	Pounds.	Value.
Albacore	2,500	$50	2,000	$40	4,600	$132	3,796	$90	4,176	$100	6,410	$186
Alewives	400,100	4,899	469,200	4,414	606,000	5,580	1,860,740	14,453	2,066,820	14,260	1,985,555	14,361
Black bass							6,935	873	9,250	1,166	12,035	1,542
Bluefish	1,426,300	51,878	917,300	37,602	685,150	28,967	9,291,125	340,939	7,227,926	264,163	4,765,873	178,691
Butter-fish	4,200	127	4,600	148	78,100	2,415	238,685	7,091	230,802	6,582	368,862	10,845
Bonito	35,600	1,074	25,900	5,036	32,200	1,098	144,750	5,144	150,633	9,857	105,643	4,000
Carp							2,525	202	2,000	160	2,025	162
Catfish	8,800	292	9,000	280	11,250	362	157,325	9,735	133,824	8,265	144,938	8,877
Cero					1,700	74	630	26	847	38	3,610	172
Cod	25,000	1,000	10,000	400	5,000	200	729,747	19,164	841,011	26,001	676,859	20,691
Dogfish							60,000	150	77,000	190	56,000	140
Drum	2,500	100	1,800	72	2,000	80	26,900	726	124,240	980	39,650	892
Eels	184,650	11,425	181,700	10,975	198,050	12,370	579,438	37,309	623,280	38,594	565,210	36,283
Flounders	110,200	4,252	157,400	5,768	233,300	9,469	923,365	32,091	987,895	33,620	1,221,172	36,645
Frostfish or tomcod	4,500	135	1,400	42	2,000	60	4,500	135	1,400	42	2,000	60
Haddock	7,500	300	5,000	200	2,500	100	18,710	638	17,940	675	16,070	487
Hake							12,040	188	12,080	204	8,526	89
Kingfish	2,000	222	1,350	178	1,100	157	49,530	2,730	33,697	2,298	26,783	1,908
Mackerel	100	12	100	12	4,300	642	9,919	987	25,117	2,316	22,907	2,747
Menhaden	129,200	730	133,500	802	4,092,200	7,673	30,391,227	63,535	20,670,542	56,974	16,565,541	48,535
Mullet	500	20	650	26	600	23	92,400	5,131	88,350	4,902	43,500	2,458
Perch, white	15,400	1,035	14,300	1,007	20,800	1,510	215,278	15,261	193,724	13,539	182,887	12,636
Perch, yellow	372,500	19,075	396,500	20,775	297,250	15,715	488,524	26,291	500,238	27,219	394,332	21,767
Pike	5,200	520	5,500	550	6,400	640	18,940	1,859	19,485	1,904	18,880	1,811
Scup	600	24	600	24	14,900	561	16,220	630	25,682	855	48,150	1,579
Sea bass	618,500	24,895	291,700	12,128	311,925	13,736	3,560,419	139,992	3,731,538	147,693	3,892,311	153,431
Shad					9,600	730	10,622,719	409,659	10,225,455	443,438	8,746,518	582,221
Sheepshead	5,000	832	5,050	869	11,614	1,901	23,566	3,772	26,290	4,013	37,337	5,461
Skates							9,300	465	7,050	353	5,700	286
Spanish mackerel	11,775	2,702	14,500	3,485	18,100	3,320	59,050	9,700	78,391	12,620	117,254	15,907
Spots and croakers	1,800	60	900	32	1,200	49	78,010	3,336	106,680	4,521	184,182	7,424
Squeteague	388,700	14,973	294,000	12,428	906,700	31,100	4,073,008	180,465	6,002,563	201,515	7,540,196	208,051
Striped bass	77,400	15,523	89,100	17,610	63,750	12,704	328,196	47,645	298,164	43,296	219,675	33,395
Sturgeon					5,200	260	455,775	11,868	452,630	10,619	448,887	8,829
Suckers	2,400	96	2,300	115	2,200	110	56,546	3,914	56,680	4,008	53,430	3,667
Tautog	5,100	181	4,900	173	6,600	226	89,945	3,654	99,437	3,894	93,630	3,723
Other fish	4,100	94	3,550	91	4,450	118	63,622	3,053	73,217	3,152	105,122	3,258
Crabs, hard							142,333	5,317	230,111	9,499	164,433	7,267
Crabs, soft	50,000	5,550	48,400	5,480	44,120	5,032	275,500	31,675	289,500	35,380	409,520	37,642
King crabs							3,335,700	8,573	2,798,980	7,534	2,025,460	5,369
Lobsters	8,000	640	5,000	400	3,000	240	185,321	13,683	165,664	12,463	143,905	10,861
Shrimp	1,050	525	1,200	600	750	500	1,050	525	1,200	600	750	500
Mussels									6,000	200		
Oysters, market	316,960	39,212	289,275	35,726	450,702	52,579	7,956,515	1,218,792	7,686,322	1,227,909	8,047,151	1,270,568
Oysters, seed	430,710	15,533	460,775	16,606	992,565	35,812	7,856,030	375,388	8,428,245	411,739	10,157,140	496,060
Clams, soft	25,000	2,000	24,000	1,920	23,000	1,840	815,270	47,090	827,000	47,700	595,450	34,620
Quahogs or hard clams	263,204	25,344	277,856	27,404	774,404	77,859	3,396,364	342,637	3,454,024	371,933	2,990,572	349,221
Terrapins	1,050	375	1,092	390	1,078	385	2,560	770	3,280	1,074	2,598	997
Turtles					1,250	25					2,795	60
Total	4,948,099	245,705	4,151,398	223,808	9,931,608	326,354	88,730,048	3,447,351	79,116,380	3,520,057	73,267,434	3,646,382

The catch by different forms of apparatus.—In the ten counties of New Jersey having vessel fisheries, oysters taken with dredges, tongs, etc., constitute a more or less important part of the yield, except in the one county of Middlesex. The yield of the vessel fisheries in 1892 was valued at $1,294,358, of which $1,171,641 represented oysters, $71,566 quahogs, $4,375 crabs, $2,436 lobsters, and $44,340 fish. Purse seines, lines, and pots are used in the capture of fish. In Atlantic, Burlington, Monmouth, and Ocean counties, seines are operated for menhaden, the yield of which fish in 1892 was 10,515,960 pounds, valued at $30,425. Lines are employed for bluefish, cod, scup, sea bass, and squeteague in Atlantic, Cae May, Cumberland, and Monmouth counties; the output in 1892 was 369,400 pounds, having a value of $13,540. Pots are used to a limited extent on vessels fishing from Cape May and Hudson counties; 8,700 pounds of eels, worth $375, and 34,800 pounds of lobsters worth $2,436, were thus taken in 1892.

The yield of the shore fisheries of New Jersey in 1892 was 49,383,552 pounds, with a value of $2,352,024. Seines took 6,442,659 pounds, valued at $153,630; gill nets, 8,945,666 pounds, valued at $568,484; fyke nets and bag nets, 820,025 pounds, valued at $39,639; pound nets, trap nets, and weirs, 10,602,607 pounds, valued at $194,919; lines, 10,568,243 pounds, valued at $404,692; pots, 247,900 pounds, valued at $15,005; dredges, tongs, rakes, etc., 11,549,952 pounds, valued at $963,147, including crabs, lobsters, shrimps, terrapins, and turtles; other minor apparatus, 206,500 pounds, valued at $12,508.

Considering fish proper, it is seen that pound nets, trap nets, and weirs take larger quantities than any other class of apparatus, squeteague constituting more than half the quantity and value of the yield. Next to the pound nets in quantity of catch and greatly surpassing them in value of products are hand and trawl lines, the bulk of whose yield consists of bluefish and sea bass. Gill nets come next in quantity of fish taken, and surpass all other apparatus in value of products, shad being the only important species thus taken. Seines are fourth in respect to both quantity and value of the yield, and have as the most prominent fish shad, striped bass, alewives, yellow perch, and squeteague. Shad, flounders, alewives, perch, and eels form the larger part of the fyke-net catch, and have more value than all the other fish.

Seines are most important in Ocean and Cape May counties, gill nets in Salem and Cumberland counties, pound nets in Monmouth and Ocean counties, fykes in Burlington and Hudson counties, and lines in Monmouth and Cape May counties.

Statement by counties, apparatus, and species of the yield of the vessel fisheries of New Jersey.

Apparatus and species	Atlantic.						Burlington.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Drum	....	....	....	....	....	....	....	....	87,000	$113	....	....
Menhaden	4,350,000	$9,062	2,400,000	$5,000	1,800,000	$4,500	7,067,100	$10,600	4,702,410	7,700	....	....
Total	4,350,000	9,062	2,400,000	5,000	1,800,000	4,500	7,067,100	10,600	4,789,410	7,813	....	....
Lines:												
Bluefish	5,200	260	1,700	85	2,000	100	....	....	....	....	....	....
Cod	66,660	1,460	83,500	2,890	79,000	3,600	....	....	....	....	....	....
Sea bass	58,000	2,900	48,000	2,400	53,000	2,300	....	....	....	....	....	....
Squeteague	2,000	100	2,000	100	3,200	160	....	....	....	....	....	....
Total	131,860	4,720	135,200	5,475	137,200	6,160	....	....	....	....	....	....
Miscellaneous:												
Oysters, market	55,664	9,417	38,962	6,657	77,700	10,075	....	....	....	....	....	....
Oysters, seed	134,960	5,836	131,950	4,905	139,825	5,116	17,500	750	17,500	750	....	....
Quahogs	46,800	4,797	51,896	5,640	39,616	4,457	....	....	....	....	....	....
Total	237,424	20,050	222,808	17,202	257,141	19,648	17,500	750	17,500	750	....	....
Grand total	4,719,284	33,832	2,758,008	27,677	2,194,341	30,308	7,084,600	11,350	4,806,910	8,563	....	....

Apparatus and species.	Cumberland.						Gloucester.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Lines:												
Sea bass	9,000	$360	....	....	10,000	$300	....	....	....	....	....	....
Dredges, rakes, and tongs:												
Oysters, market	3,957,513	573,718	3,692,696	$577,661	4,185,580	649,650	8,400	$900	....	....	....	....
Oysters, seed	4,349,275	198,958	4,817,827	228,606	5,887,105	291,965	17,500	875	....	....	17,500	$875
Total	8,306,788	772,676	8,510,523	806,267	10,072,685	941,615	25,900	1,775	....	....	17,500	875
Grand total	8,315,788	773,036	8,510,523	806,267	10,082,685	941,915	25,900	1,775	....	....	17,500	875

Statement by counties, apparatus, and species of the yield of the vessel fisheries of New Jersey—Continued.

Apparatus and species.	Camden.						Cape May.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Lines:												
Bluefish	800	$40					8,700	$385	5,100	$235	3,700	$185
Scup							3,000	180	1,500	75		
Sea bass	3,700	148					91,500	3,410	60,500	2,205	38,000	1,420
Squeteague	4,500	135					32,000	1,250	4,000	130	2,000	80
Total	9,000	323					135,200	5,225	71,100	2,645	43,700	1,685
Pots.												
Eels							8,000	480	9,500	430	3,700	125
Dredges, rakes, and tongs:												
Oysters, market	363,398	52,990	395,738	$61,670	469,350	$73,625	167,300	25,694	81,550	14,650	127,960	20,680
Oysters, seed	488,600	22,130	570,500	28,050	658,700	32,970	126,700	6,325	144,550	7,358	234,500	12,005
Total	851,998	75,120	966,238	89,720	1,128,050	106,595	294,000	32,019	226,100	22,008	362,460	32,685
Grand total	860,998	75,443	966,238	89,720	1,128,050	106,595	437,200	37,724	306,700	25,083	409,860	34,495

Apparatus and species.	Hudson.						Middlesex.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Pots:												
Eels	6,000	$300	5,600	$280	5,000	$250						
Lobsters	30,000	2,000	35,400	2,478	34,800	2,436	11,250	$600				
Total	36,000	2,300	41,000	2,758	39,800	2,686	11,250	600				
Dredges, rakes, and tongs:												
Oysters, market	65,100	9,300	38,500	5,500	42,000	6,000						
Quahogs (hard clams)							1,600	163	8,000	$1,250		
Total	65,000	9,300	38,500	5,500	42,000	6,000	1,600	163	8,000	1,250		
Grand total	101,100	11,600	79,500	8,258	81,800	8,686	12,850	763	8,000	1,250		

Apparatus and species.	Monmouth.						Ocean.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Menhaden	12,265,800	$24,350	7,535,610	$25,794	4,834,560	$19,484					3,881,400	$6,441
Lines:												
Bluefish	271,000	11,130	225,000	6,300	146,500	4,395	20,000	$1,600				
Sea bass	35,000	1,050	40,000	1,000	30,000	900						
Squeteague	2,500	125	2,000	100	2,000	100						
Total	308,500	12,305	267,000	7,400	178,500	5,395	20,000	1,600				
Pots:												
Eels	1,923	115										
Dredges, rakes, and tongs:												
Oysters, market	512,750	70,906	564,340	82,195	471,905	67,600					700	80
Oysters, seed	84,000	6,000	4,200	300							23,800	1,000
Quahogs (hard clams)	505,272	53,007	591,144	72,373	436,048	64,009	10,500	1,109	20,256	$2,154	24,500	3,100
Mussels			6,000	200								
Crabs	102,333	2,788	184,111	6,634	118,233	4,375						
Total	1,204,355	132,701	1,349,795	161,702	1,026,186	135,984	10,500	1,109	20,256	2,154	49,000	4,180
Grand total	13,780,578	169,471	9,152,405	194,896	6,039,246	160,863	30,500	2,709	20,256	2,154	3,930,400	10,621

Statement by counties, apparatus, and species of the yield of the vessel fisheries of New Jersey—Continued.

Apparatus and species.	Total for State.					
	1890.		1891.		1892.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:						
Drum			87,000	$113		
Menhaden	23,682,900	$44,012	14,638,020	38,494	10,515,960	$30,425
Total	23,682,900	44,012	14,725,020	38,607	10,515,960	30,425
Lines:						
Bluefish	305,700	13,415	231,800	6,620	152,200	4,680
Cod	66,660	1,460	83,500	2,890	79,000	3,600
Scup	3,000	180	1,500	75		
Sea bass	197,200	7,868	148,500	5,605	131,000	4,920
Squeteague	41,000	1,610	8,000	330	7,200	340
Total	613,560	24,533	473,300	15,520	369,400	13,540
Pots:						
Eels	15,923	895	15,100	710	8,700	375
Lobsters	41,250	2,600	35,400	2,478	34,800	2,436
Total	57,173	3,495	50,500	3,188	43,500	2,811
Dredges, rakes, and tongs:						
Oysters, market	5,130,125	742,925	4,811,786	748,333	5,375,195	827,710
Oysters, seed	5,218,535	240,874	5,686,527	269,969	6,961,430	343,931
Quahogs (hard clams)	564,172	59,076	671,296	81,417	500,164	71,566
Mussels			6,000	200		
Crabs	102,333	2,788	184,111	6,634	118,233	4,375
Total	11,015,165	1,045,663	11,359,720	1,106,553	12,955,022	1,247,582
Grand total	35,368,798	1,117,703	26,608,540	1,163,868	23,883,882	1,294,358

Statement by counties, apparatus, and species of the yield of the shore fisheries of New Jersey.

Apparatus and species.	Gloucester.						Hudson.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Alewives	55,786	$186	80,858	$267	58,288	$197						
Catfish	10,071	604	7,200	432	9,428	566						
Menhaden									25,000	$500	16,000	$320
Perch, white	4,356	261	3,786	227	3,428	206						
Perch, yellow	12,914	774	11,500	690	10,714	643						
Pike	171	17	171	18	114	11						
Shad	22,558	600	25,380	650	19,343	675						
Striped bass	500	50	643	64	457	45						
Suckers	514	31	328	19	214	13						
Other fish	100	5	71	3	86	4						
Total	106,970	2,528	129,937	2,370	102,072	2,360			25,000	500	16,000	320
Gill nets:												
Shad	644,700	25,788	614,950	28,112	678,650	50,414	360,000	$16,200	320,000	16,000	252,000	15,750
Striped bass	2,956	355	2,457	295	1,623	195						
Total	647,656	26,143	617,407	28,407	680,273	50,609	360,000	16,200	320,000	16,000	252,000	15,750
Fyke nets:												
Alewives							1,000	15	800	12	900	13
Eels							1,050	53	1,000	50	1,000	50
Perch, white							2,400	48	2,459	49	2,300	46
Shad							166,000	6,225	124,000	4,960	130,000	5,850
Striped bass							2,800	140	2,700	135	2,500	125
Total							173,250	6,481	130,959	5,206	136,700	6,084
Miscellaneous:												
Lobsters							21,500	1,075	20,000	1,000	15,000	750
Oysters, market							52,500	9,000	49,000	8,400	42,000	7,200
Oysters, seed							247,800	17,700	245,000	17,500	210,000	15,000
Total							321,800	27,775	314,000	26,900	267,000	22,950
Grand total.	754,626	28,671	747,344	30,777	782,345	52,969	855,050	50,456	789,959	48,606	671,700	45,104

Statement by counties, apparatus, and species of the yield of the shore fisheries of New Jersey—Continued.

Apparatus and species.	Atlantic.						Bergen.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Alewives	30,180	$617	34,980	$690	25,880	$497						
Bluefish	3,000	150	3,500	175	1,500	75						
Eels	6,500	325	6,000	300	4,200	210						
Flounders	24,000	1,095	23,800	1,090	15,100	755						
Kingfish	3,000	180	4,000	240	4,200	252						
Menhaden	21,500	47	24,000	51	18,000	43						
Perch, white	28,000	1,500	29,200	1,416	31,500	1,530						
Shad	800	57	760	56	1,360	81						
Sheepshead	1,200	120	1,200	120	1,500	150						
Squeteague	228,800	12,510	256,000	15,130	245,525	13,770						
Striped bass	12,000	2,024	14,100	1,450	11,800	1,324						
Other fish	6,000	300	7,700	385	6,000	300						
Total	364,980	18,925	405,240	21,103	366,565	18,987						
Gill nets:												
Menhaden							20,800	$62	25,000	$75	25,000	$75
Perch, white	16,500	1,395	12,500	1,100	4,000	300						
Pike	635	50	600	48	500	40						
Shad							459,200	18,040	391,200	16,764	425,600	20,560
Squeteague	500	20	600	24								
Striped bass	1,300	115	1,000	85			31,500	3,780	27,000	3,240	25,300	3,035
Total	18,935	1,580	14,700	1,257	4,500	340	511,500	21,882	443,200	20,079	475,900	23,670
Fyke nets and bag nets:												
Perch, white	10,000	800	5,000	400	5,000	400						
Striped bass	6,000	1,500	4,500	1,125	4,600	1,150						
Total	16,000	2,300	9,500	1,525	9,600	1,550						
Lines:												
Bluefish	84,200	5,295	87,500	5,380	92,500	5,310						
Drum	7,500	112	11,000	145	3,500	52						
Flounders	53,900	1,762	56,000	2,410	47,800	1,342						
Kingfish	8,000	400	6,000	300	1,000	100						
Sea bass	5,200	265	5,000	260	3,100	111						
Sheepshead	4,500	750	2,000	300	1,000	100						
Spots and croakers	14,000	582	34,000	1,385	92,500	3,830						
Squeteague	1,387,500	62,260	1,381,500	61,585	952,400	40,185						
Striped bass	2,000	200	1,000	100	300	30						
Tautog	2,500	125	2,000	100	1,000	50						
Total	1,569,300	71,751	1,586,000	71,965	1,195,100	51,110						
Pots:												
Eels							10,000	800	12,000	960	12,800	1,025
Minor apparatus:												
Eels	3,500	175	3,000	150								
Miscellaneous:												
Terrapins	1,510	395	1,340	366	1,200	308						
Quahogs	555,104	53,445	500,208	50,488	414,904	45,873						
Oysters, market	675,850	117,830	681,450	116,908	736,050	124,903						
Oysters, seed	383,600	13,350	469,000	15,190	619,570	19,822						
Total	1,616,064	185,023	1,651,998	182,952	1,771,724	190,906						
Grand total	3,588,779	279,754	3,670,438	278,952	3,347,489	262,893	521,500	22,682	455,200	21,039	488,700	24,695

Apparatus and species.	Hunterdon and Warren.						Mercer.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Alewives	29,000	$290	31,500	$315	29,200	$292	8,000	$83	7,650	$80	7,500	$75
Catfish	20,861	1,170	19,606	1,072	17,963	990	2,565	120	2,420	112	1,850	95
Perch, white	2,932	185	2,805	178	2,242	146	800	50	710	45	985	60
Perch, yellow	4,862	273	4,732	286	4,387	252	1,130	45	1,340	54	1,070	43
Pike	2,360	210	2,770	245	2,450	220	520	40	415	35	680	58
Shad	57,828	5,373	58,100	5,354	52,090	4,719	21,314	2,063	20,981	1,895	18,968	1,666
Striped bass	1,820	182	2,095	211	1,840	185	610	60	763	75	460	45
Suckers	3,150	78	2,730	80	4,120	100						
Other fish	7,032	428	6,750	449	7,461	476	1,320	52	890	39	1,125	34
Total	129,845	8,189	131,088	8,190	121,753	7,380	36,259	2,513	35,169	2,335	32,038	2,076
Gill nets:												
Shad							38,850	2,910	24,850	1,880	19,250	1,016
Other fish							2,900	145	2,000	100	2,700	135
Total							41,750	3,055	26,850	1,980	21,950	1,151
Grand total	129,845	8,189	131,088	8,190	121,753	7,380	78,009	5,568	62,019	4,315	54,588	3,227

Statement by counties, apparatus, and species of the yield of the shore fisheries of New Jersey—Continued.

Apparatus and species.	Burlington.						Camden.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Alewives	532,860	$3,027	498,040	$2,870	474,080	$2,711	126,200	$1,262	118,400	$1,184	110,320	$1,103
Bluefish	4,200	175	3,500	145								
Butter-fish	2,900	65	2,950	67								
Catfish	3,800	120	4,000	125	3,500	110						
Drum			240	3								
Flounders	6,600	300	7,800	355	2,500	125						
Kingfish	900	42	800	38	500	25						
Menhaden	23,500	55	36,750	83								
Perch, white	13,200	970	13,100	950	10,000	760						
Perch, yellow	600	48	800	64								
Pike	4,100	350	4,000	340	3,800	320						
Sea bass	3,000	120	3,200	130								
Shad	204,184	10,840	197,774	10,505	182,537	10,657	318,850	18,220	298,550	17,060	266,000	15,200
Sheepshead	1,200	120	600	60								
Spots and croakers	1,000	50	1,000	50	500	25						
Squeteague	109,000	4,595	112,000	4,800	3,000	120						
Striped bass	14,300	2,645	14,100	2,570	7,200	1,450						
Suckers	3,100	69	3,150	69	2,900	63						
Other fish	100	5	100	5								
Total	928,544	23,596	903,904	23,229	690,517	16,366	445,050	19,482	416,950	18,244	376,320	16,303
Gill nets:												
Perch, white	450	33	800	52	1,200	84						
Pike	750	72	1,300	118	2,100	198						
Shad	357,525	20,071	333,288	18,835	285,950	15,286	366,800	14,672	346,850	15,856	372,050	28,638
Squeteague			4,000	200	10,000	500						
Striped bass			100	8	300	24	2,000	240	2,124	255	1,000	120
Suckers	400	12	500	15	1,000	30						
Other fish	8,800	440	9,300	465	8,300	415						
Total	367,925	20,628	349,288	19,693	308,850	16,537	368,800	14,912	348,974	16,111	373,050	28,758
Fyke nets and bag nets:												
Alewives	182,850	916	199,550	999	183,595	918						
Black bass	2,060	288	2,800	392	4,885	684						
Carp	2,525	202	2,000	160	2,025	162						
Catfish	37,700	2,896	33,565	2,625	31,925	2,499						
Eels	22,340	1,518	17,280	1,207	19,200	1,344						
Flounders	2,920	146	2,200	110	2,400	120						
Perch, white	53,980	4,303	55,550	4,444	58,595	4,687						
Perch, yellow	15,200	1,201	11,680	934	13,025	1,042						
Shad	7,340	362	6,524	328	6,950	349						
Striped bass	29,075	5,781	21,110	4,254	21,935	4,600						
Suckers	43,525	3,422	45,450	3,576	41,560	3,265						
Other fish	11,125	835	10,925	814	9,455	704						
Total	410,640	21,870	408,634	19,843	395,550	20,374						
Lines:												
Black bass	4,875	585	6,450	774	7,150	858						
Catfish	10,000	701	11,650	816	10,350	725						
Eels	9,325	653	7,550	529	6,480	454						
Flounders	15,000	600	12,500	500								
Sea bass	4,200	180	3,700	160								
Squeteague	165,000	5,850	85,500	3,900								
Striped bass	13,200	1,584	11,575	1,389	9,675	1,161						
Other fish	2,225	134	2,625	158	2,250	136						
Total	223,825	10,287	141,550	8,226	35,905	3,334						
Pots:												
Eels	20,000	1 000	24,000	1,200	4,000	200						
Minor apparatus:												
Eels	5,500	275	5,000	250								
Miscellaneous:												
Quahogs	798,104	79,810	764,400	76,442	98,800	9,880						
Oysters, market	274,295	28,502	279,524	29,288	71,050	6,598						
Oysters, seed	346,542	10,876	342,300	10,224	126,000	3,600						
Total	1,418,941	119,188	1,386,224	115,954	295,850	20,078						
Grand total	3,375 375	196,844	3,218,600	188,395	1,730,672	76,889	813,850	34,394	765,924	34,355	749,370	45,061

Statement by counties, apparatus, and species of the yield of the shore fisheries of New Jersey—Continued.

Apparatus and species.	Cape May.						Cumberland.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Alewives	48,800	$530	36,400	$384	32,800	$347	17,350	$173	16,500	$165	15,400	$154
Bluefish	27,300	2,087	9,600	642	17,500	675						
Butter-fish	15,200	676	14,100	613	23,000	810						
Catfish	1,000	80	1,000	80	500	40	2,099	126	2,183	131	1,600	96
Drum	3,000	36	8,000	87	13,000	137						
Eels	55,000	3,363	54,500	3,298	57,300	3,575						
Flounders	50,400	2,644	49,200	2,506	61,800	3,212						
Kingfish	13,800	930	12,100	799	8,800	563						
Menhaden	156,900	544	84,500	420	91,750	429						
Mullet	91,900	5,111	87,700	4,876	42,900	2,435						
Perch, white	24,200	2,070	18,000	1,532	12,000	1,048	2,116	127	1,800	108	2,350	141
Perch, yellow							3,332	200	4,186	251	3,500	210
Pike	4,000	480	3,500	420	2,000	240	175	17	200	20	150	15
Sea bass	2,000	140	4,000	280	3,000	210						
Shad	2,000	175	1,450	118	890	70	13,500	675	14,500	725	12,500	625
Sheepshead	300	45	100	15								
Spanish mack'l					500	50						
Spots and croakers	14,500	710	9,500	445	14,600	500						
Squeteague	292,000	12,295	264,500	11,165	192,500	8,800						
Striped bass	71,700	7,430	46,850	4,945	27,600	3,228	350	35	350	35	250	25
Suckers							400	22	250	15	159	9
Tautog	1,600	160	1,500	120	1,000	80						
Other fish	1,500	60	1,200	48	1,000	40						
Total	877,100	39,566	707,700	32,793	604,350	26,489	39,322	1,375	39,969	1,450	35,900	1,275
Gill nets:												
Alewives	5,400	58	6,000	71	5,880	68						
Bluefish	45,000	2,250	12,000	710	18,000	1,040						
Butter-fish	20,000	600										
Drum					5,000	50						
Flounders					1,500	40						
Kingfish	15,000	450										
Menhaden	35,000	250	140,000	1,200	70,000	750						
Perch, white	1,000	100	1,000	100	800	80						
Shad							556,412	19,077	585,900	23,436	478,800	32,832
Spanish mack'l			200	20	200	20						
Spots and croakers	10,000	500	1,500	75	1,000	50						
Squeteague	35,000	1,400	23,500	990	21,000	880						
Striped bass							1,666	200	1,333	160	2,083	250
Sturgeon					12,750	255	438,350	11,233	428,700	9,562	390,125	7,310
Total	166,400	5,608	184,200	3,166	136,130	3,233	996,428	30,510	1,015,933	33,158	871,008	40,392
Fyke nets:												
Eels	650	65	3,750	250	550	55						
Perch, white	700	35	600	30	715	36						
Squeteague	6,500	195	6,000	180	5,000	150						
Striped bass	930	65	1,000	70	1,110	80						
Total	8,780	360	11,350	530	7,375	321						
Pound nets:												
Eels	1,300	91	1,200	84	600	42						
Flounders	7,800	212	7,100	184	3,300	92						
Perch, white	800	24	800	24	600	18						
Perch, yellow	500	25	500	25	100	5						
Shad	2,300	168	2,200	164	900	67						
Squeteague	205,000	5,530	172,000	5,180	80,450	2,736						
Striped bass	10,400	728	11,400	798	4,200	284						
Total	228,100	6,778	195,200	6,459	90,150	3,244						
Lines:												
Bluefish	147,400	7,580	103,800	5,340	228,500	11,515						
Bonito	1,000	50	2,000	100	2,000	100						
Cod			10,000	360	46,000	2,760						
Drum	13,900	478	16,200	560	15,250	555						
Flounders	14,200	653	16,800	729	15,000	610						
Kingfish	5,400	300	6,700	375	9,000	510						
Scup	2,500	100	8,000	320	10,000	400						
Sea bass	521,300	20,867	950,900	38,186	1,855,000	74,320						
Sheepshead	2,000	500										
Spots and croakers	29,100	1,204	52,200	2,248	67,400	2,806						
Squeteague	159,000	6,060	185,500	6,875	148,400	6,311						
Striped bass	1,000	100	1,500	150	1,000	100						
Tautog	3,000	240	4,000	320	3,000	240						
Total	899,800	38,132	1,357,600	55,563	2,400,550	100,227						
Pots:												
Eels					5,000	250						
Minor apparatus:												
Alewives	30,000	350	24,000	280	33,000	413						
Eels	10,000	615	11,500	695	12,000	725						
Total	40,000	965	35,500	975	45,000	1,138						

Statement by counties, apparatus, and species of the yield of the shore fisheries of New Jersey—Continued.

Apparatus and species.	Cape May.						Cumberland.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Miscellaneous:												
Crabs, hard	33,200	$2,325	38,000	$2,625	40,000	$2,700						
Crabs, king	3,094,100	7,781	2,552,600	6,719	1,810,460	4,728	241,600	$792	226,380	$690	194,000	$510
Quahogs	212,800	16,510	293,600	20,816	395,200	25,256						
Oysters, market	215,950	34,329	269,675	43,981	285,425	46,456	14,175	1,865	14,175	1,865	24,675	3,365
Oysters, seed	46,900	2,480	42,000	2,225	51,100	2,620	286,643	10,625	339,143	12,275	499,275	18,775
Total	3,602,950	63,425	3,195,875	76,366	2,582,185	81,760	542,418	13,282	579,698	14,830	717,950	22,650
Grand total	5,823,130	154,834	5,687,425	175,852	5,870,740	216,662	1,578,168	45,167	1,635,600	49,438	1,624,858	64,317

Apparatus and species.	Middlesex.						Monmouth.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Alewives							11,000	$220	12,500	$250	12,000	$240
Bluefish	19,500	$780	7,000	$350	2,300	$115	1,500	60	1,000	40	1,000	30
Eels							600	30	600	30	500	25
Flounders	4,000	200	4,500	225	7,500	375	900	36	1,000	40	1,000	40
Menhaden	1,458,333	2,625	1,541,666	2,775	2,166,666	3,900	4,200	9	3,500	20		
Perch, white							2,800	140	3,500	175	3,000	150
Shad	5,600	210	6,400	256	6,000	300	10,000	500	12,000	600	9,600	480
Squeteague	8,000	480	8,500	510	3,500	210	49,000	1,960	46,000	1,840	40,100	1,203
Striped bass	7,500	600	6,500	520	2,000	160	12,000	1,670	10,700	1,270	7,800	856
Total	1,502,933	4,895	1,574,566	4,636	2,187,966	5,060	92,000	4,625	90,800	4,265	75,000	3,024
Gill nets:												
Bluefish							107,635	4,678	109,600	4,765	104,600	3,587
Butter-fish							100	3	100	3	120	4
Cod									45,800	1,603	300	15
Dogfish							60,000	150	77,000	190	56,000	140
Flounders							1,000	30	1,000	40	1,200	48
Menhaden							1,275	12	4,263	42	2,200	20
Shad	10,400	390	9,500	356	8,000	300	61,700	3,515	52,000	3,250	55,200	3,590
Spanish mack'l							24,305	3,778	26,210	4,155	21,891	3,910
Squeteague							82,765	2,828	90,300	3,349	81,220	2,962
Sturgeon											200	10
Other fish	2,900	145					400	20	760	38	1,375	75
Total	13,300	535	9,500	356	8,000	300	339,180	15,014	407,033	17,435	324,306	14,361
Fyke nets:												
Bluefish							900	45	1,000	50	850	43
Butter-fish							1,500	75	3,000	150	2,500	125
Eels							24,950	1,130	43,150	2,787	22,750	1,570
Flounders	900	39	1,500	60	15,000	670	42,600	1,724	29,900	1,247	29,200	1,210
Menhaden							29,166	53	29,167	53	25,000	45
Perch, white	5,500	330					4,000	286	5,100	339	2,800	200
Scup							1,000	50	2,100	105	400	20
Sea bass							1,000	48	1,100	53	800	40
Shad	14,500	755	12,500	543	7,500	395	4,500	275	4,000	240	4,000	250
Spots and croakers							5,000	180	6,500	265	3,500	125
Squeteague	550	33	500	30			4,000	202	6,000	305	4,700	237
Striped bass	5,200	516	2,400	192	200	16	2,150	212	2,550	274	1,950	208
Tautog							2,400	84	2,900	115	2,100	90
Other fish	600	30	500	25			1,700	85	2,700	71	23,050	224
Total	27,250	1,703	17,400	850	22,700	1,081	124,866	4,449	139,167	6,054	123,600	4,387
Pound nets:												
Albacore							1,296	40	1,176	40	810	34
Alewives							47,500	713	45,300	681	41,000	90
Bluefish					700	56	104,850	4,770	189,979	8,547	108,013	4,305
Bonito							26,500	1,060	54,733	2,141	47,318	1,877
Butter-fish							194,785	5,545	206,052	5,601	265,142	7,491
Cero							630	26	847	38	1,910	98
Cod							3,987	120	2,294	64	4,659	110
Eels											50	3
Flounders					500	30	122,545	3,145	189,767	4,461	472,747	9,499
Kingfish							1,430	206	2,247	278	2,183	301
Mackerel							9,819	975	25,017	2,304	18,607	2,105
Menhaden			100,000	660	12,500	83	4,828,453	15,136	3,885,176	11,799	3,411,665	11,213
Scup							8,720	260	12,982	311	22,400	580
Sea bass							15,860	610	29,188	946	91,215	3,502
Shad							83,610	4,975	91,118	5,862	91,163	5,973
Sheepshead							9,266	1,385	17,240	2,629	23,123	3,290
Spanish mack'l							22,570	3,160	36,981	4,885	76,163	8,547
Spots and croakers							2,610	50	1,080	21	3,482	39

Statement by counties, apparatus, and species of the yield of the shore fisheries of New Jersey—Continued.

Apparatus and species.	Middlesex.						Monmouth.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Pound nets:												
Squeteague							673,507	$39,380	2,840,299	$65,156	4,786,590	$96,796
Striped bass							4,500	360	6,000	480	5,000	400
Sturgeon							17,425	635	23,930	1,057	40,612	994
Tautog							4,870	98	12,437	261	4,235	81
Other fish					300	$18	12,220	245	23,217	419	32,056	543
Total			100,000	$660	14,000	187	6,196,953	82,894	7,697,060	117,981	9,550,143	158,376
Lines:												
Albacore									1,000	20	1,000	20
Bluefish							7,033,640	249,376	5,550,347	193,797	3,353,060	118,293
Bonito							81,650	2,960	68,000	2,580	24,125	925
Cod							634,100	16,584	689,417	20,684	541,900	14,006
Drum											900	18
Eels							12,300	195	13,700	224	6,380	110
Flounders							466,400	15,253	427,428	13,895	311,325	9,008
Haddock							11,210	338	12,940	475	13,570	387
Hake							12,040	188	12,080	204	8,526	89
Kingfish									500	90		
Scup							400	16	500	20	450	18
Sea bass							2,192,159	84,999	2,294,250	89,945	1,496,271	56,592
Sheepshead							100	20	100	20	100	20
Skates							9.300	465	7,050	353	5,700	286
Spanish mack'l							400	60	500	75	400	60
Squeteague							237,186	8,284	217,864	7,538	51,911	1,751
Striped bass							300	45	900	135		
Tautog							70,475	2,766	71,700	2,805	75,695	2,956
Other fish									500	20	5,000	10
Total							10,761,660	381,549	9,368,776	332,880	5,896,313	204,549
Pots:												
Eels	800	$80	500	50	200	20	95,750	7,485	129,000	8,175	108,450	7,315
Minor apparatus:												
Eels							99,300	7,136	92,750	6,670	97,000	6,565
Miscellaneous:												
Crabs, soft							225,500	26,125	241,100	29,900	365,400	32,610
Crabs, hard							6,800	204	8,000	240	6,200	192
Crabs, king									20,000	125	21,000	131
Lobsters							114,571	9,368	105,264	8,585	91,105	7,435
Terrapins									848	318	320	304
Turtles											1,545	35
Clams							790,270	45,090	803,000	45,780	572,450	32,780
Quahogs	4,830	480	5,440	544	2,400	225	994,680	107,331	947,080	115,176	813,200	119,662
Oysters, market	281,400	47,838	239,400	40,698	256,900	43,673	995,260	197,288	1,052,037	202,710	805,854	158,164
Oysters, seed	283,500	20,250	301,000	21,500	285,600	20,400	16,800	1,200	17,500	1,250	15,400	1,100
Total	569,700	68,568	545,840	62,742	544,900	64,298	3,143,881	386,606	3,194,829	404,084	2,692,474	352,413
Grand total	2,113,983	75,781	2,247,806	69,294	2,777,766	70,906	20,853,590	889,758	21,119,415	897,544	18,867,286	750,990

Apparatus and species.	Salem.						Union.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Alewives	334,714	$1,114	485,142	$1,598	349,712	$1,163						
Catfish	60,429	3,626	43,200	2,592	56,572	3,394						
Perch, white	26,144	1,569	22,714	1,363	20,572	1,234						
Perch, yellow	77,486	4,650	69,000	4,140	64,286	3,857						
Pike	1,029	103	1,029	110	686	69						
Shad	135,348	7,295	152,280	8 233	116,057	6,095						
Striped bass	3,000	300	3,857	386	2,743	275						
Suckers	3,057	184	1,972	119	1,286	77						
Other fish	600	30	429	22	514	26						
Total	641,807	18,871	779,623	18,563	612,428	16,190						
Gill nets:												
Shad	6,696,900	230,228	6,518,400	261,400	5,235,650	359,648						
Striped bass	10,039	1,205	8,457	1,015	10,999	1,320						
Total	6,706,939	231,433	6,526,857	262,415	5,246,649	360,968						
Miscellaneous:												
Quahogs							14,000	$1,750	14,400	$1,800	16,000	$2,000
Oysters, seed							595,000	42,500	525,000	45,000	420,000	36,000
Total							609,000	44,250	539,400	46,800	436,000	38,000
Grand total	7,348,746	250,304	7,306,480	280,978	5.859,077	377,158	609,000	44.250	539,400	46,800	436,000	38,000

Statement by counties, apparatus, and species of the yield of the shore fisheries of New Jersey—Continued.

Apparatus and species.	Ocean.						Total.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Alewives	397,200	$4,857	461,500	$4,325	598,500	$5,490	1,591,090	$12,359	1,783,470	$12,128	1,713,680	$12,269
Bluefish	13,400	586	5,300	215	4,600	187	68,900	3,838	29,900	1,567	26,900	1,082
Butter-fish	2,000	49	1,700	41	2,500	81	20,100	790	18,750	721	25,500	891
Catfish	8,800	292	9,000	280	11,250	362	109,625	6,138	88,609	4,824	102,663	5,653
Drum							3,000	36	8,240	90	13,000	137
Eels	14,150	1,135	11,100	890	12,100	970	76,250	4,853	72,200	4,518	74,100	4,780
Flounders	1,400	56	9,260	44	2,400	100	87,300	4,331	95,500	4,260	90,300	4,607
Kingfish	800	100	500	65	400	33	18,500	1,252	17,400	1,142	13,900	873
Menhaden	77,000	524	88,000	612	166,300	1,044	1,741,433	3,804	1,803,416	4,461	2,458,716	5,736
Mullet	500	20	650	26	690	23	92,400	5,131	88,350	4,902	43,500	2,458
Perch, white	7,600	452	9,100	567	12,800	792	112,148	7,324	104,715	6,561	98,877	6,067
Perch, yellow	363,500	18,175	377,500	18,875	280,500	14,040	463,824	24,165	469,058	24,360	364,457	19,045
Pike	5,200	520	5,500	550	6,400	640	17,555	1,737	17,585	1,738	16,280	1,573
Sea bass	1,500	60	1,200	48	1,900	76	6,500	320	8,400	458	4,900	286
Shad							791,982	46,008	788,175	45,452	685,255	40,568
Sheepshead	3,900	710	4,100	760	2,500	465	6,800	995	6,000	955	4,000	615
Spanish mackerel											500	50
Spots and croakers	900	33	700	26	1,000	43	16,400	793	11,200	521	16,100	568
Squeteague	107,600	4,244	88,600	3,544	56,000	2,320	794,400	36,084	775,600	36,989	540,625	26,423
Striped bass	70,600	13,965	80,700	15,750	56,050	10,950	194,380	28,961	180,658	27,276	118,200	18,543
Suckers	2,400	96	2,300	115	2,200	110	12,621	480	10,730	417	10,870	372
Tautog	500	20	400	16	400	16	2,100	180	1,900	136	1,400	96
Other fish	2,900	58	2,150	43	2,750	58	19,552	938	19,290	994	18,936	938
Total	1,081,850	45,952	1,159,200	46,792	1,221,150	37,800	6,216,660	190,517	6,399,146	184,470	6,442,659	153,630
Gill nets:												
Alewives	2,900	42	7,700	89	7,500	90	8,300	100	13,700	160	13,380	158
Bluefish	154,700	7,218	133,000	6,292	100,800	4,908	307,335	14,146	254,000	11,767	223,400	9,535
Bonito			300	12	200	8			300	12	200	8
Butter-fish	2,200	78	2,900	107	2,600	94	22,300	681	3,000	110	2,720	98
Cod									45,800	1,603	300	15
Dogfish							60,000	150	77,600	190	56,000	140
Drum											5,000	50
Flounders	2,600	58	2,400	60	1,900	49	3,600	88	3,400	100	4,600	137
Kingfish	800	74	550	77	200	35	15,800	524	550	77	200	35
Mackerel	100	12	100	12	600	87	100	12	100	12	600	87
Menhaden	52,200	206	45,500	190	44,500	188	109,275	530	214,763	1,507	141,700	1,033
Perch, white	500	25	200	10	200	10	18,450	1,553	14,500	1,262	6,200	474
Perch, yellow	9,000	900	19,000	1,900	16,750	1,675	9,000	900	19,000	1,900	16,750	1,675
Pike							1,385	122	1,900	166	2,600	238
Shad							9,552,487	350,891	9,196,938	385,889	7,811,150	528,034
Sheepshead	1,100	122	950	109	6,500	952	1,100	122	950	109	6,500	952
Spanish mackerel	7,275	1,252	9,000	1,535	8,100	1,350	31,580	5,030	35,410	5,710	30,191	5,280
Spots and croakers	900	27	200	6	200	6	10,900	527	1,700	81	1,200	56
Squeteague	80,100	3,184	92,400	3,844	45,800	1,523	198,365	7,432	210,800	8,407	158,020	5,865
Striped bass	3,400	850	6,900	1,560	6,000	1,400	52,861	6,745	49,371	6,618	47,305	6,344
Sturgeon							438,350	11,233	428,700	9,562	403,075	7,575
Suckers							400	12	500	15	1,000	30
Other fish	1,200	36	1,400	48	1,200	40	16,200	786	13,460	651	13,575	665
Total	318,975	14,084	322,500	15,851	243,050	12,415	10,857,788	401,584	10,586,442	435,908	8,945,666	568,484
Fyke nets and bag nets:												
Alewives							183,850	931	200,350	1,011	184,495	931
Black bass							2,060	288	2,800	392	4,885	684
Bluefish							900	45	1,000	50	850	43
Butter-fish							1,500	75	3,000	150	2,500	125
Carp							2,525	202	2,000	160	2,025	162
Catfish							37,700	2,896	33,565	2,625	31,925	2,499
Eels	8,500	850	4,500	300	4,000	400	57,490	3,616	69,680	4,594	47,500	3,419
Flounders	23,700	948	54,500	2,180	104,500	4,180	70,120	2,857	88,160	3,597	151,100	6,180
Frostfish or tomcod	4,500	135	1,400	42	2,000	60	4,500	135	1,400	42	2,000	60
Menhaden							29,166	53	29,167	53	25,000	45
Perch, white	7,300	558	5,000	430	7,800	708	83,880	6,360	73,709	5,692	77,210	6,077
Perch, yellow							15,200	1,201	11,680	934	13,025	1,042
Scup							1,000	50	2,100	105	400	20
Sea bass							1,000	48	1,100	53	800	40
Shad							192,340	7,617	147,024	6,071	148,450	6,844
Spots and croakers							5,000	180	6,500	265	3,500	125
Squeteague							11,050	430	12,500	515	9,700	387
Striped bass	3,400	708	1,500	300	1,700	354	49,555	8,922	35,760	6,350	33,995	6,533
Suckers							43,525	3,422	45,450	3,576	41,560	3,265
Tautog	2,300	69	2,300	69	4,000	120	4,700	153	5,200	184	6,100	210
Other fish					500	20	13,425	950	14,125	910	33,005	948
Total	49,700	3,268	69,200	3,321	124,500	5,842	810,486	40,431	786,210	37,329	820,025	39,639

Statement by counties, apparatus, and species of the yield of the shore fisheries of New Jersey—Continued.

Apparatus and species.	Ocean.						Total.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Pound nets:												
Albacore					3,100	$102	1,296	$40	1,176	$40	3,910	$136
Alewives							47,500	713	45,300	681	41,000	590
Bluefish					23,000	1,180	104,850	4,770	189,979	8,547	131,713	5,541
Bonito					21,000	860	26,500	1,060	54,733	2,141	68,318	2,737
Butter-fish					73,000	2,240	194,785	5,545	206,052	5,601	338,142	9,731
Cero					1,700	74	630	26	847	38	3,610	172
Cod							3,987	120	2,294	64	4,659	110
Eels							1,300	91	1,200	84	650	45
Flounders					50,500	1,715	130,345	3,357	196,867	4,645	527,047	11,336
Kingfish					300	65	1,430	206	2,247	278	2,483	366
Mackerel					3,700	555	9,819	975	25,017	2,304	22,307	2,660
Menhaden							4,828,453	15,136	3,985,176	12,459	3,424,165	11,296
Perch, white							800	24	800	24	600	18
Perch, yellow							500	25	500	25	100	5
Scup					14,500	545	8,720	260	12,982	311	36,900	1,125
Sea bass					51,500	2,415	15,860	610	29,188	946	142,715	5,947
Shad					9,600	720	85,910	5,143	93,318	6,026	101,663	6,775
Sheepshead					2,614	484	9,266	1,385	17,246	2,629	25,737	3,774
Spanish mackerel					7,500	1,420	22,570	3,160	36,981	4,885	83,663	9,967
Spots and croakers							2,610	50	1,080	21	3,482	39
Squeteague					680,900	20,427	878,507	44,910	3,012,299	70,336	5,547,940	119,959
Striped bass							14,900	1,088	17,400	1,278	9,200	684
Sturgeon					5,200	260	17,425	635	23,930	1,057	45,812	1,254
Tautog					* 200	10	4,870	98	12,437	261	4,435	91
Other fish							12,220	245	23,217	419	32,356	561
Total					948,314	33,112	6,425,053	89,672	7,992,260	125,100	10,602,607	194,919
Lines:												
Albacore	2,500	$50	2,000	$40	1,500	30	2,500	50	3,000	60	2,500	50
Black bass							4,875	585	6,450	774	7,150	858
Bluefish	1,238,200	42,474	779,000	31,095	556,750	22,692	8,503,440	304,725	6,520,647	235,612	4,230,810	157,810
Bonito	35,600	1,074	25,600	5,024	11,000	230	118,250	4,084	95,600	7,704	37,125	1,255
Catfish							10,000	701	11,650	816	10,350	725
Cod	25,000	1,000	10,000	400	5,000	200	659,100	17,584	709,417	21,444	592,900	16,966
Drum	2,500	100	1,800	72	2,000	80	23,900	690	29,000	777	21,650	705
Eels							21,625	848	21,250	753	12,860	564
Flounders	82,500	3,190	91,300	3,484	74,000	3,425	632,000	21,458	604,028	21,018	448,125	14,385
Haddock	7,500	300	5,000	200	2,500	100	18,710	638	17,940	675	16,070	487
Hake							12,040	188	12,080	204	8,526	89
Kingfish	400	48	300	36	200	24	13,800	748	13,500	801	10,200	634
Scup	600	24	600	24	400	16	3,500	140	9,100	364	10,850	434
Sea bass	617,000	24,835	290,500	12,080	258,525	11,215	3,339,859	131,146	3,544,350	140,631	3,612,896	142,238
Sheepshead							6,600	1,270	2,100	320	1,100	120
Skates							9,300	465	7,050	353	5,700	286
Spanish mackerel	4,500	1,450	5,500	1,950	2,500	550	4,900	1,510	6,000	2,025	2,900	610
Spots and croakers							43,100	1,786	86,200	3,633	159,900	6,636
Squeteague	201,000	7,545	113,000	5,040	124,000	6,830	2,149,686	89,999	1,983,364	84,938	1,276,711	55,077
Striped bass							16,500	1,929	14,975	1,774	10,975	1,291
Tautog	2,300	92	2,200	88	2,000	80	78,275	3,223	79,900	3,313	81,695	3,326
Other fish							2,225	134	3,125	178	7,250	146
Total	2,219,600	82,182	1,326,800	59,533	1,040,375	45,472	15,674,185	583,901	13,780,726	528,167	10,568,243	404,692
Pots:												
Eels	99,500	4,975	105,100	5,255	117,450	6,195	226,050	14,340	270,600	15,640	247,960	15,005
Minor apparatus:												
Alewives							30,000	350	24,000	280	33,000	413
Eels	62,500	4,465	61,000	4,530	64,500	4,805	180,800	12,666	173,250	12,295	173,500	12,095
Total							210,800	13,016	197,250	12,575	206,500	12,508
Miscellaneous:												
Crabs, soft	50,000	5,550	48,400	5,480	44,120	5,032	275,500	31,675	289,500	35,380	409,520	37,642
Crabs, hard							40,000	2,529	46,000	2,865	46,200	2,892
Crabs, king							3,335,700	8,573	2,798,980	7,534	2,025,460	5,369
Lobsters	8,000	640	5,000	400	3,000	210	144,071	11,083	130,264	9,985	105,105	8,425
Shrimp	1,050	525	1,200	600	750	500	1,050	525	1,200	600	750	500
Terrapins	1,050	375	1,092	390	1,078	385	2,560	770	3,280	1,074	2,598	997
Turtles					1,250	25					2,795	60
Clams	25,000	2,000	24,000	1,920	23,000	1,840	815,270	47,090	827,000	47,700	595,450	34,620
Quahogs	252,704	24,235	257,600	25,250	749,904	74,759	2,832,192	283,561	2,782,728	290,516	2,490,408	277,655
Oysters, market	316,960	39,212	289,275	35,726	450,002	52,499	2,826,390	475,867	2,874,536	479,576	2,671,956	442,858
Oysters, seed	430,710	15,533	460,775	16,606	968,765	34,812	2,637,495	134,514	2,741,718	141,770	3,195,710	152,129
Total	1,085,474	88,070	1,087,342	86,372	2,241,869	170,092	12,910,228	996,187	12,495,206	1,017,000	11,549,952	963,147
Grand total	4,917,599	242,996	4,131,142	221,654	6,001,208	315,733	53,361,250	2,329,648	52,507,840	2,356,189	49,383,552	2,352,024

* Taken in pots.

FISHERIES OF PENNSYLVANIA.

General features of the fisheries.—The fishing industry of Pennsylvania is of less extent than in any other Middle State except Delaware, and, if only the local waters are considered, the fisheries are insignificant. The rank of Pennsylvania among the coast and lake States, including the fisheries of Lake Erie, which are not covered by the present report, is eighteenth.

Pennsylvania is the only State of this region that does not have a frontage on salt water. By means of a small fleet of vessels, however, it maintains extensive fisheries in salt water, in Delaware Bay and the adjacent ocean. Two very important rivers, the Delaware and the Susquehanna, are within the State, and contain an abundance of resident and anadromous fish. In these all of the commercial fishing is done. The larger part of the yield is marketed in Philadelphia and Baltimore. Besides receiving large quantities of fishery products from points within the State, Philadelphia also has an exceedingly extensive fish trade with Chesapeake Bay, Delaware Bay, and the ocean shores of New Jersey, Delaware, Maryland, and Virginia. The city is the principal catfish and eel market of the United States.

The leading branches of the industry are the extensive seine and gill-net fisheries for shad in the two rivers and the oyster vessel fishery in Delaware Bay tributary to Philadelphia. This is the only State in which the oyster fishery is not of prime importance. Alewives are taken under the same conditions as shad, and rank second among the fishes found in the State limits, but are less valuable than the sea bass caught in the salt-water vessel fisheries.

Statistical summary.—The extent of the fisheries of this State in 1889, 1890, 1891, and 1892 is shown in the three following tables.

The number of persons engaged in the industry in 1892 was less than in any of the preceding years, the decrease being mostly due to a reduced fleet of oyster vessels. The fishing population in 1889 was 2,331, and in 1892 was 2,220. In the last year the vessel fishermen numbered 288, the shore and boat fishermen 1,615, the shoresmen 310, and the transporters 7.

The investment in 1892 was $976,011, and was larger than in any of the other years, the decline in vessel property being more than compensated for in shore property and cash capital. Forty vessels were employed, against 58 in 1889. The small boats numbered 817. Seines, gill nets, and fyke nets were the only important apparatus for fish proper; these were valued at $45,169, while all other apparatus was worth only $5,047.

The product of the fisheries in 1892 was 6,324,508 pounds, valued at $284,031. In 1889, 7,165,777 pounds were taken, worth $324,530. The decrease was chiefly in shad and oysters, the catch of the former being reduced on account of an unfavorable season, the diminished output of the latter being due to less extensive operations.

Persons employed in the fisheries of Pennsylvania.

How engaged.	1889.	1890.	1891.	1892.
In vessel fisheries	382	365	348	288
In shore fisheries	1,652	1,619	1,631	1,615
On transporting vessels	6	5	5	7
On shore, in markets, etc	291	302	289	310
Total	2,331	2,291	2,273	2,220

Vessels, boats, apparatus, shore property, and cash capital employed in the fisheries of Pennsylvania.

Designation.	1889.		1890.		1891.		1892.	
	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.
Vessels fishing	56	$103,350	51	$93,650	47	$84,900	37	$68,125
Tonnage	1,388		1,270		1,194		957	
Outfit		19,005		19,895		19,410		16,835
Vessels transporting	2	3,700	2	3,000	2	2,875	3	3,350
Tonnage	42		26		26		33	
Outfit		135		120		110		130
Boats	850	30,950	837	31,046	837	30,652	817	29,535
Apparatus—vessel fisheries:								
Dredges	208	6,210	188	5,675	164	5,035	132	4,025
Lines		156		176		206		136
Apparatus—shore fisheries:								
Seines	153	20,185	151	19,130	151	19,405	141	18,750
Gill nets	220	22,340	219	22,320	209	21,450	205	21,200
Fyke nets	2,611	5,523	2,583	5,384	2,534	5,264	2,532	5,219
Lines		410		412		427		398
Minor nets		501		467		494		488
Shore property and accessories		416,970		440,410		450,162		495,420
Cash capital		298,640		295,600		303,750		312,400
Total		928,075		937,285		944,140		976,011

Products of the fisheries of Pennsylvania.

Species.	1889.		1890.		1891.		1892.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives	1,989,985	$13,325	2,447,500	$13,894	2,331,775	$13,449	2,059,015	$12,144
Black bass	22,015	2,278	21,125	2,190	22,885	2,368	21,743	2,242
Carp	3,295	177	3,435	180	3,800	199	3,784	197
Codfish	147,771	7,038	142,217	6,690	132,468	6,223	134,650	6,293
Eels	41,762	2,249	42,545	2,258	40,950	2,174	44,085	2,305
Perch, white	7,160	413	7,068	402	6,020	341	6,170	343
Perch, yellow	10,415	685	13,160	705	12,625	674	12,308	468
Pike	8,805	813	5,520	777	4,975	697	5,481	777
Sea bass	614,420	24,140	802,600	28,606	947,500	33,805	901,564	37,555
Shad	2,752,572	125,717	2,898,551	131,226	2,692,864	128,274	1,996,482	110,200
Strawberry bass	987	89	750	70	880	80	1,050	102
Striped bass	24,360	2,374	22,865	2,233	24,615	2,406	23,352	2,320
Sturgeon	63,750	750	58,650	810	52,700	640	60,180	728
Suckers	53,895	2,568	48,105	2,369	42,550	2,115	43,570	2,213
Other fish	87,165	4,394	85,825	4,339	83,350	4,156	84,414	4,294
Oysters	*1,337,420	137,520	†1,249,290	131,450	‡1,183,700	124,420	§926,660	101,850
Total	7,165,777	324,530	7,849,206	328,199	7,583,657	322,021	6,324,508	284,031

*191,060 bushels. †178,470 bushels. ‡169,100 bushels. §132,380 bushels.

Statistics of the fisheries by counties.—Two counties in Pennsylvania on the Susquehanna River and seven on the Delaware River have commercial fisheries. The following tables indicate the extent to which each of these was interested in the fishing industry in 1890, 1891, and 1892.

The counties bordering on the Delaware River, viz, Bucks, Delaware, Monroe, Philadelphia, and Pike, had a fishing population in 1892 of 1,585, and those on the Susquehanna—Lancaster and York—had 635. Of the former number, 940 were in Philadelphia County. Lancaster County had 471 and Bucks County 438 persons, all of whom were shore fishermen.

The capital invested in the fishing industry of the counties bordering on the Delaware River was $963,570, of which $916,485 was credited to Philadelphia County. The value of the fishery investment on the Susquehanna River was $12,441. All the vessels in the State belong in Philadelphia County, which also has rather important fishing carried on with seines, gill nets, and fyke nets. Seines and gill nets, however, are used in larger numbers in Bucks County than elsewhere, while fykes are more numerous in Philadelphia County than in all the remainder of the State.

The yield of the fisheries of the Delaware River, including the salt-water fishing by Philadelphia vessels, was 6,002,268 pounds, having a value to the fishermen of $262,268, while the counties on the Susquehanna River took products to the quantity of 322,240 pounds, valued at $21,763. Philadelphia County, with its extensive vessel fishery, easily takes first rank among the counties of the State, the value of the output being $178,345, of which $139,405 represents oysters and sea bass. In the extent of the fisheries prosecuted within the limits of the State, Bucks County occupies the first place, with a catch valued at $44,585. The shad is the preeminent fish in Pennsylvania, and in every fishing county except Philadelphia is more valuable than all other fish combined.

Statement by counties of the number of persons employed in the fisheries of Pennsylvania.

Counties.	In vessel fisheries.			In shore fisheries.			On transporting vessels.			On shore, in markets, etc.			Total.		
	1890.	1891.	1892.	1890.	1891.	1892.	1890.	1891.	1892.	1890.	1891.	1892.	1890.	1891.	1892.
Bucks	......	......	......	444	449	438	......	......	......	......	......	......	444	449	438
Delaware	......	......	......	188	184	186	......	......	......	......	......	......	188	184	186
Lancaster	......	......	......	458	469	471	......	......	......	......	......	......	458	469	471
Monroe and Pike	......	......	......	21	21	21	......	......	......	......	......	......	21	21	21
Philadelphia	365	348	288	348	340	335	5	5	7	302	289	310	1,020	982	940
York	......	......	......	160	168	164	......	......	......	......	......	......	160	168	164
Total	365	348	288	1,619	1,631	1,615	5	5	7	302	289	310	2,291	2,273	2,220

Statement by counties of the vessels, boats, apparatus, shore property, and cash capital employed in the fisheries of Pennsylvania.

Designation.	Bucks.						Delaware.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Boats	254	$9,770	245	$9,460	223	$8,490	93	$5,960	91	$5,830	92	$5,895
Apparatus:												
Seines	80	11,060	77	11,180	66	10,460	1	500	1	500	1	500
Gill nets	56	4,690	51	4,340	49	4,250	110	12,860	107	12,520	108	12,630
Fyke nets	403	1,389	380	1,330	330	1,160	65	130	70	140	72	144
Lines	......	250	......	245	......	216	.....	......	.....	......	.....	......
Shore property and accessories	......	2,560	......	2,505	......	2,360	.....	190	.....	190	.....	210
Total	......	29,719	......	29,060	......	26,936	.....	19,640	.....	19,180	.....	19,379

Designation.	Lancaster.						Monroe and Pike.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Boats	278	$4,287	289	$4,464	293	$4,510	8	$195	8	$195	8	$195
Apparatus:												
Seines	40	2,370	43	2,495	44	2,550	4	420	4	420	4	420
Fyke nets	49	285	43	260	50	297	.....	......	.....	......	.....	......
Lines	......	121	......	139	......	140	.....	......	.....	......	.....	......
Minor nets	129	382	136	400	132	390	.....	......	.....	......	.....	......
Shore property and accessories	......	1,510	......	1,527	......	1,560	.....	160	.....	150	.....	155
Total	......	8,955	......	9,285	......	9,447	.....	775	.....	765	.....	770

Statement by counties of the vessels, boats, apparatus, shore property, and cash capital employed in the fisheries of Pennsylvania—Continued.

Designation.	Philadelphia.						York.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	51	$93,650	47	$84,900	37	$68,125						
Tonnage	1,270		1,194		957							
Outfit		19,895		19,410		16,835						
Vessels transporting	2	3,000	2	2,875	3	3,350						
Tonnage	26		26		33							
Outfit		120		110		130						
Boats	114	9,410	110	9,200	107	8,970	90	$1,424	94	$1,503	94	$1,475
Apparatus—vessel fisheries:												
Dredges	188	5,675	164	5,035	132	4,025						
Lines		176		206		136						
Apparatus—shore fisheries:												
Seines	12	4,000	11	3,980	11	3,980	14	780	15	830	15	840
Gill nets	53	4,770	51	4,590	48	4,320						
Fyke nets	2,050	3,485	2,026	3,444	2,061	3,504	16	95	15	90	19	114
Lines								41		43		42
Minor nets							31	85	34	94	36	98
Shore property and accessories		435,600		445,360		490,710		390		430		425
Cash capital		295,600		303,750		312,400						
Total		875,381		882,860		916,485		2,815		2,990		2,994

Designation.	Total for State.					
	1890.		1891.		1892.	
	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	51	$93,650	47	$84,900	37	$68,125
Tonnage	1,270		1,194		957	
Outfit		19,895		19,410		16,835
Vessels transporting	2	3,000	2	2,875	3	3,350
Tonnage	26		26		33	
Outfit		120		110		130
Boats	837	31,046	837	30,652	817	29,535
Apparatus—vessel fisheries:						
Dredges	188	5,675	164	5,035	132	4,025
Lines		176		206		136
Apparatus—shore fisheries:						
Seines	151	19,130	151	19,405	141	18,750
Gill nets	219	22,320	209	21,450	205	21,200
Fyke nets	2,583	5,384	2,534	5,264	2,532	5,219
Lines		412		427		398
Minor nets	160	467	170	494	168	488
Shore property and accessories		440,410		450,162		495,420
Cash capital		295,600		303,750		312,400
Total		937,285		944,140		976,011

Statement by counties and species of the products of the fisheries of Pennsylvania.

Species.	Bucks.						Delaware.					
	1890.		1891.		1892		1890.		1891.		1892.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives	1,934,500	$9,672	1,808,275	$9,047	1,559,575	$7,800	356,000	$3,325	366,000	$3,500	337,640	$3,350
Black bass	4,845	561	5,385	618	5,635	639						
Carp	275	22	300	24	265	21						
Catfish	15,075	1,057	15,135	1,014	15,300	1,062	4,500	225	5,000	250	5,200	260
Eels	8,025	560	7,225	506	7,190	502	900	50	1,000	55	1,000	50
Perch, white	2,210	141	2,225	135	2,300	138						
Perch, yellow	1,860	112	2,125	122	1,700	108						
Shad	634,380	36,814	659,055	35,911	526,544	29,104	773,500	30,260	741,650	29,690	569,870	29,335
Striped bass	5,075	584	6,460	733	5,685	648						
Sturgeon							58,650	810	52,700	640	60,180	728
Suckers	18,550	1,303	19,850	1,308	19,700	1,378						
Other fish	62,975	3,226	61,450	3,129	61,724	3,185						
Total	2,687,770	54,052	2,587,485	52,587	2,265,618	44,585	1,193,550	34,670	1,166,350	34,135	973,890	33,723

Statement by counties and species of the products of the fisheries of Pennsylvania—Continued.

Species.	Lancaster.						Monroe and Pike.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives							99,000	$537	99,500	$542	97,800	$534
Black bass	11,625	$1,163	12,375	$1,238	10,982	$1,096	780	78	1,000	100	1,040	104
Carp	2,250	112	2,625	131	2,537	127						
Catfish	3,019	136	3,375	168	2,860	132	7,117	487	10,333	620	9,050	547
Eels	10,163	556	10,350	573	10,315	567						
Perch, white							1,858	111	1,595	96	1,470	85
Perch, yellow	6,375	319	5,850	292	6,420	132	2,800	168	2,700	162	2,490	138
Pike	3,375	506	3,000	450	3,456	524	1,020	102	975	97	1,025	103
Shad	130,235	9,303	95,529	6,823	120,484	8,607	70,637	3,619	72,920	3,646	73,706	3,761
Strawberry bass							750	70	880	80	1,050	102
Striped bass	9,750	878	10,650	959	9,620	869	990	99	955	95	1,175	117
Suckers	5,575	140	5,025	125	5,710	142						
Other fish	13,000	627	11,850	521	12,190	594	2,250	112	2,100	105	2,480	124
Total	195,367	13,740	160,629	11,280	184,574	12,790	187,202	5,383	192,958	5,543	191,286	5,615

Species.	Philadelphia.						York.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds	Value.	Pounds.	Value.	Pounds.	Value.
Alewives	58,000	$360	58,000	$360	64,000	$460						
Black bass							3,875	$388	4,125	$412	4,086	$403
Carp							910	46	875	44	982	49
Catfish	111,500	4,740	97,500	4,085	101,000	4,230	1,006	45	1,125	56	1,240	62
Eels	20,000	900	19,000	855	22,000	990	3,457	192	3,375	185	3,580	196
Perch, white	3,000	150	2,200	110	2,400	120						
Perch, yellow							2,125	106	1,950	98	1,698	90
Pike							1,125	169	1,000	150	1,000	150
Sea bass	802,600	28,606	947,500	33,805	901,564	37,555						
Shad	1,215,375	46,578	1,018,150	45,607	594,650	32,180	74,424	4,652	105,560	6,597	111,228	7,213
Striped bass	3,800	380	3,000	300	3,200	320	3,250	292	3,550	319	3,672	366
Suckers	22,000	880	16,000	640	16,000	640	1,980	46	1,675	42	2,160	53
Other fish							7,600	374	7,950	391	8,020	391
Oysters	1,249,290*	131,450	1,183,700†	124,420	926,660‡	101,850						
Total	3,485,565	214,044	3,345,050	210,182	2,631,474	178,345	99,752	6,310	131,185	8,294	137,666	8,973

Species.	Total for State.					
	1890.		1891.		1892.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives	2,447,500	$13,894	2,331,775	$13,449	2,059,015	$12,144
Black bass	21,125	2,190	22,885	2,308	21,743	2,242
Carp	3,435	180	3,800	199	3,784	197
Catfish	142,217	6,690	132,468	6,223	134,650	6,293
Eels	42,545	2,258	40,950	2,174	44,085	2,305
Perch, white	7,068	402	6,020	341	6,170	343
Perch, yellow	13,160	705	12,625	674	12,308	468
Pike	5,520	777	4,975	697	5,481	777
Sea bass	802,600	28,600	947,500	33,805	901,564	37,555
Shad	2,898,551	131,226	2,692,864	128,274	1,996,482	110,200
Strawberry bass	750	70	880	80	1,050	102
Striped bass	22,865	2,233	24,615	2,406	23,352	2,320
Sturgeon	58,650	810	52,700	640	60,180	728
Suckers	48,105	2,369	42,550	2,115	43,570	2,213
Other fish	85,825	4,339	83,350	4,156	84,414	4,294
Oysters	1,249,290	131,450	1,183,700	124,420	926,660	101,850
Total	7,849,206	328,199	7,583,657	322,021	6,324,508	284,031

* 178,470 bushels. † 169,100 bushels. ‡ 132,380 bushels.

The products specified by apparatus of capture.—In the vessel fisheries of this State carried on from Philadelphia only sea bass and oysters were taken in 1892, the apparatus used being lines and dredges, respectively. The catch of sea bass was 901,564 pounds, valued at $37,555, and the oyster production was 132,380 bushels, worth $101,850. The results of the vessel fisheries in 1890, 1891, and 1892 are given.

The shore fisheries yielded 4,496,284 pounds of fish, with a value of $144,626, of which seines took 3,104,386 pounds, valued at $82,913; gill nets 1,118,140 pounds, valued at $45,741; fyke nets 158,860 pounds, valued at $7,152; lines 75,319 pounds, valued at $6,094, and dip nets 39,579 pounds, valued at $2,726. Seines are the most important means of capture in Bucks, Lancaster, Philadelphia, Pike, and York counties, while in Delaware County gill nets are the principal apparatus. Detailed figures showing the yield of each apparatus in each county are given in the table.

Statement by apparatus and species of the products of the vessel fisheries of Pennsylvania.

Apparatus and species.	1890.		1891.		1892.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Lines:						
Catfish	9,500	$400	9,000	$380		
Sea bass	862,600	28,606	947,500	33,805	901,564	$37,555
Total	812,100	29,006	956,500	34,185	901,564	37,555
Dredges:						
Oysters	* 1,249,290	131,450	† 1,183,700	124,420	‡ 926,660	101,850
Grand total	2,061,390	160,456	2,140,200	158,605	1,828,224	139,405

* 178,470 bushels. † 169,100 bushels. ‡ 132,380 bushels.

Statement by counties, apparatus, and species of the yield of the shore fisheries of Pennsylvania.

Apparatus and species.	Lancaster.						Monroe and Pike.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Alewives							99,000	$537	99,500	$542	97,800	$534
Black bass							780	78	1,000	100	1,040	104
Catfish							7,117	487	10,333	620	9,050	547
Perch, white							1,858	111	1,595	96	1,470	85
Perch, yellow							2,800	168	2,700	162	2,490	138
Pike							1,020	102	975	97	1,025	103
Shad	94,654	$6,761	71,435	$5,102	89,859	$6,419	70,637	3,619	72,920	3,646	73,706	3,761
Strawberry bass							750	70	880	80	1,050	102
Striped bass							990	99	955	95	1,175	117
Other fish	9,700	480	9,100	403	8,990	450	2,250	112	2,100	105	2,480	124
Total	104,354	7,241	80,535	5,505	98,849	6,869	187,202	5,383	192,958	5,543	191,286	5,615
Fyke nets:												
Carp	2,250	112	2,625	131	2,537	127						
Eels	3,450	207	3,225	194	3,175	190						
Suckers	5,575	140	5,025	125	5,710	142						
Total	11,275	459	10,875	450	11,422	459						
Dip nets:												
Eels	1,575	94	1,800	113	2,000	120						
Shad	35,581	2,542	24,094	1,721	30,625	2,188						
Other fish	1,500	75	800	40	1,250	62						
Total	38,656	2,711	26,694	1,874	33,875	2,370						
Lines:												
Black bass	11,625	1,163	12,375	1,238	10,982	1,096						
Catfish	3,019	136	3,375	168	2,860	132						
Eels	5,138	255	5,325	266	5,140	257						
Perch, yellow	6,375	319	5,850	292	6,420	132						
Pike	3,375	506	3,000	450	3,456	524						
Striped bass	9,750	878	10,650	959	9,620	869						
Other fish	1,800	72	1,950	78	1,950	82						
Total	41,082	3,329	42,525	3.451	40,428	3,092						
Grand total	195 367	13.740	160,629	11,280	184.574	12,790	187,202	5,383	192,958	5,543	191,286	5,615

Statement by counties, apparatus, and species of the yield of the shore fisheries of Pennsylvania—Cont'd.

Apparatus and species.	Bucks.						Delaware.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Alewives	1,928,900	$9,643	1,803,200	$9,021	1,554,775	$7,775	140,000	$975	144,000	$1,025	124,000	$910
Black bass	595	62	900	93	1,125	121						
Catfish	4,225	296	4,650	309	5,050	338						
Shad	489,200	29,906	516,580	29,205	392,468	22,907	56,000	2,200	56,350	2,250	46,900	2,085
Striped bass	625	67	1,325	137	1,075	108						
Suckers	6,450	451	7,100	497	6,400	481						
Other fish	49,725	2,509	48,625	2,454	48,574	2,462						
Total	2,479,720	42,934	2,382,380	41,716	2,009,467	34,192	196,000	3,175	200,350	3,275	170,900	2,995
Gill nets:												
Alewives							216,000	2,350	222,000	2,475	213,640	2,440
Shad	144,800	6,889	142,000	6,681	133,600	6,173	717,500	28,060	685,300	27,440	522,970	27,250
Sturgeon							58,650	810	52,700	640	60,180	728
Other fish	8,300	419	7,800	390	8,200	430						
Total	153,100	7,308	149,800	7,071	141,800	6,603	992,150	31,220	960,000	30,555	796,790	30,418
Fyke nets:												
Alewives	5,600	29	5,075	26	4,800	25						
Black bass	600	61	675	68	525	52						
Carp	275	22	300	24	265	21						
Catfish	5,650	396	5,025	352	4,575	327	4,500	225	5,000	250	5,200	260
Eels	3,200	223	3,100	218	2,675	186	900	50	1,000	55	1,000	50
Perch, white	2,210	141	2,225	135	2,300	138						
Perch, yellow	1,860	112	2,125	122	1,700	108						
Shad	380	19	475	25	476	24						
Striped bass	775	77	970	96	575	57						
Suckers	12,100	852	12,750	811	13,300	897						
Other fish	2,650	154	2,475	142	2,425	142						
Total	35,300	2,086	35,195	2,019	33,616	1,977	5,400	275	6,000	305	6,200	310
Lines:												
Black bass	3,650	438	3,810	457	3,985	466						
Catfish	5,200	365	5,460	383	5,675	397						
Eels	4,825	337	4,125	288	4,515	316						
Striped bass	3,675	440	4,165	500	4,035	483						
Other fish	2,300	144	2,550	153	2,525	151						
Total	19,650	1,724	20,110	1,781	20,735	1,813						
Grand total	2,687,770	54,052	2,587,485	52,587	2,205,618	44,585	1,193,550	34,670	1,166,350	34,135	973,890	33,723

Apparatus and species.	Philadelphia.						York.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Alewives	58,000	$360	58,000	$360	64,000	$460						
Catfish	26,000	1,300	16,500	825	19,800	990						
Perch, white	3,000	150	2,200	110	2,400	120						
Shad	910,000	34,800	757,400	35,280	415,100	23,460	69,960	$4,373	100,624	$6,289	106,104	$6,892
Striped bass	3,800	380	3,000	300	3,200	320						
Suckers	22,000	880	16,000	640	16,000	640						
Other fish							7,000	350	7,300	365	7,280	360
Total	1,022,800	37,870	853,100	37,515	520,500	25,990	76,960	4,723	107,924	6,654	113,384	7,252
Gill nets:												
Shad	305,375	11,778	260,750	10,327	179,550	8,720						
Fyke nets:												
Carp							910	46	875	44	982	49
Catfish	76,000	3,040	72,000	2,880	81,200	3,240						
Eels	20,000	900	19,000	855	22,000	990	1,120	70	1,075	64	1,280	74
Suckers							1,980	46	1,675	42	2,160	53
Total	96,000	3,940	91,000	3,735	103,200	4,230	4,010	162	3,625	150	4,422	176
Dip nets:												
Eels							620	37	525	32	580	35
Shad							4,464	279	4,936	308	5,124	321
Total							5,084	316	5,461	340	5 704	356

Statement by counties, apparatus, and species of the yield of the shore fisheries of Pennsylvania—Cont'd.

Apparatus and species.	Philadelphia.						York.					
	1890.		1891.		1892.		1891.		1890.		1892.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Lines:												
Black bass							3,875	$388	4,125	$412	4,086	$403
Catfish							1,006	45	1,125	56	1,240	62
Eels							1,717	85	1,775	89	1,720	87
Perch, yellow							2,125	106	1,950	98	1,698	90
Pike							1,125	169	1,000	150	1,000	150
Striped bass							3,250	292	3,550	319	3,672	366
Other fish							600	24	650	26	740	31
Total							13,698	1,109	14,175	1,150	14,156	1,189
Grand total	1,424,175	$53,588	1,204,850	$51,577	803,250	$38,940	99,752	6,310	131,185	8,294	137,666	8,973

Apparatus and species.	Total for the State.					
	1890.		1891.		1892.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:						
Alewives	2,225,900	$11,515	2,104,700	$10,948	1,840,575	$9,679
Black bass	1,375	140	1,900	193	2,165	225
Catfish	37,342	2,083	31,483	1,754	33,900	1,875
Perch, white	4,858	261	3,795	206	3,870	205
Perch, yellow	2,800	168	2,700	162	2,490	138
Pike	1,020	102	975	97	1,025	103
Shad	1,690,451	81,659	1,575,309	81,772	1,124,137	65,524
Strawberry bass	750	70	880	80	1,050	102
Striped bass	5,415	546	5,280	532	5,450	545
Suckers	28,450	1,331	23,100	1,137	22,400	1,121
Other fish	68,675	3,451	67,125	3,327	67,324	3,396
Total	4,067,036	101,326	3,817,247	100,208	3,104,386	82,913
Gill nets:						
Alewives	216,000	2,350	222,000	2,475	213,640	2,440
Shad	1,167,675	46,727	1,088,050	44,448	836,120	42,143
Sturgeon	58,650	810	52,700	640	60,180	728
Other fish	8,300	419	7,800	390	8,200	430
Total	1,450,625	50,306	1,370,550	47,953	1,118,140	45,741
Fyke nets:						
Alewives	5,600	29	5,075	26	4,800	25
Black bass	600	61	675	68	525	52
Carp	3,435	180	3,800	199	3,784	197
Catfish	86,150	3,661	82,025	3,482	90,975	3,827
Eels	28,670	1,450	27,400	1,386	30,130	1,490
Perch, white	2,210	141	2,225	135	2,300	138
Perch, yellow	1,860	112	2,125	122	1,700	108
Shad	380	19	475	25	476	24
Striped bass	775	77	970	96	575	57
Suckers	19,655	1,038	19,450	978	21,170	1,092
Other fish	2,650	154	2,475	142	2,425	142
Total	151,985	6,922	146,695	6,659	158,860	7,152
Dip nets:						
Eels	2,195	131	2,325	145	2,580	155
Shad	40,045	2,821	29,030	2,029	35,749	2,509
Other fish	1,500	75	800	40	1,250	62
Total	43,740	3,027	32,155	2,214	39,579	2,726
Lines:						
Black bass	19,150	1,989	20,310	2,107	19,053	1,965
Catfish	9,225	546	9,960	607	9,775	591
Eels	11,680	677	11,225	643	11,375	660
Perch, yellow	8,500	425	7,800	390	8,118	222
Pike	4,500	675	4,000	600	4,456	674
Striped bass	16,675	1,610	18,365	1,778	17,327	1,718
Other fish	4,700	240	5,150	257	5,215	264
Total	74,430	6,162	76,810	6,382	75,319	6,094
Grand total	5,787,816	167,743	5,443,457	163,416	4,496,284	144,626

FISHERIES OF DELAWARE.

Importance and general aspects of the industry.—The fisheries of this State are the least extensive in the Middle Atlantic region, although, in proportion to the length of shore line, the industry is of considerable importance and is surpassed in value by that of Pennsylvania by only a few thousand dollars. The rank of Delaware as a fishing State is 21.

Delaware has a frontage on the ocean, on Delaware Bay and River, and also has a river of some size, the Nanticoke, tributary to Chesapeake Bay. Fishing is carried on along the ocean shore of the State, in Delaware Bay, and in the rivers mentioned, but is most extensive in Delaware Bay. The proximity of Wilmington, Philadelphia, and Baltimore affords a good market for the fishery products taken.

The oyster fishery is usually of greater importance than any other branch, although at times the shad fishery has become the most valuable. The taking of alewives, eels, perch, squeteague, striped bass, sturgeon, and crabs is also comparatively extensive. In the extent of its sturgeon fishery Delaware not only surpasses the other States of this section, but takes first rank among the coast States of the country. It is also noticeable as being the southernmost State in which lobster fishing is carried on.

Condensed statistical statement.—General statistics of the fisheries of Delaware in 1889, 1890, 1891, and 1892 are given in the three tables which follow.

Of the total fishing population in 1892, 153 persons were in the vessel fisheries, 1,692 in the shore fisheries, and 494 in menhaden factories and oyster houses. A slight annual increase in all classes of fishery employés is indicated by the returns.

The $218,144 invested in the fishing industry of Delaware in 1892 consisted of $42,540 in vessels and their outfits, $29,754 in boats, $50,050 in apparatus of capture, and $95,800 in shore property and cash capital. During the four years covered by the inquiry, the variation in the aggregate investment and in the individual items was slight. Comparing 1892 with 1889, there was a small increase in the number of vessels, gill nets, pound nets, and eel pots, and a decrease in the number of boats, seines, fyke nets, and lobster pots.

The value of the products in 1892 was less than in any of the three previous years, owing to a diminished catch of shad, squeteague, sturgeon, and perch. The somewhat larger yield of eels, striped bass, crabs, and oysters was not sufficient to overcome the reduction in the other species. The fisheries resulted in the following returns to the fishermen: 1889, $256,980; 1890, $267,346; 1891, $255,423; 1892, $250,853.

Persons employed in the fisheries of Delaware.

How engaged.	1889.	1890.	1891.	1892.
In vessel fisheries	103	103	103	107
In shore fisheries	1,645	1,669	1,653	1,692
On transporting vessels	25	41	43	46
On shore, in factories, etc	380	366	431	494
Total	2,153	2,179	2,230	2,339

Vessels, boats, apparatus, shore property, and cash capital employed in the fisheries of Delaware.

Designation.	1889.		1890.		1891.		1892.	
	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.
Vessels fishing	25	$22,035	25	$21,740	25	$21,525	26	$21,175
Tonnage	297		297		304		313	
Outfit		3,575		3,555		3,390		3,630
Vessels transporting	11	13,450	15	12,550	16	13,250	17	15,580
Tonnage	225		207		224		256	
Outfit		1,395		1,865		1,975		2,155
Boats	971	29,040	972	28,965	946	29,233	968	29,754
Apparatus—vessel fisheries:								
Dredges	100	2,100	100	2,070	100	2,110	104	2,195
Apparatus—shore fisheries:								
Seines	204	10,610	206	10,340	203	10,263	199	10,083
Gill nets	1,502	33,469	1,587	33,424	1,586	33,946	1,603	34,373
Pound nets and weirs	20	280	22	380	20	305	27	455
Fyke nets	622	1,365	617	1,355	567	1,261	540	1,220
Cast nets	11	44	12	48	13	52	9	48
Crab nets	170	85	148	74	122	61	167	84
Eel pots	1,695	737	1,785	771	1,775	784	1,876	827
Lobster pots	45	112	40	100	40	100	21	53
Lines		36		21		20		20
Spears	170	85	170	85	170	85	195	100
Tongs and rakes	243	522	246	534	243	522	262	592
Shore property		49,080		45,900		44,800		48,300
Cash capital		42,300		43,000		44,400		47,500
Total		210,320		206,777		208,082		218,144

Products of the fisheries of Delaware.

Species.	1889.		1890.		1891.		1892.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives	843,700	$12,515	827,050	$12,098	863,760	$12,412	848,890	$11,585
Catfish	75,200	4,231	75,800	4,261	73,800	4,074	72,695	4,010
Croakers and spots	68,200	3,470	56,900	2,995	42,460	2,280	39,190	1,911
Drum	32,000	400	34,000	425	30,000	380	31,020	393
Eels	249,900	9,895	226,100	9,124	223,500	8,967	269,120	10,635
Flounders	5,400	162	5,300	178	5,000	168	5,120	172
Kingfish	2,000	100	1,600	80	960	48	240	12
Menhaden	61,000	385	58,000	370	67,000	420	65,500	405
Mullet	36,750	1,141	36,400	1,116	38,900	1,125	40,300	1,204
Perch	255,500	16,563	251,750	16,264	255,855	16,139	211,415	14,019
Pike	24,110	1,511	24,460	1,530	24,950	1,548	25,840	1,604
Shad	1,498,653	64,903	1,797,218	66,812	1,500,196	64,699	1,110,369	60,255
Squeteague	3,211,900	20,562	3,102,000	19,845	1,164,730	17,524	837,510	16,364
Striped bass	109,610	14,750	107,220	14,432	94,910	12,758	115,042	15,442
Sturgeon	1,327,300	26,730	1,301,600	29,350	1,304,800	30,448	1,051,590	24,510
Suckers	10,800	505	10,250	500	11,050	501	8,930	442
Tautog	5,000	200	5,000	200	8,000	320	8,300	332
Other fish	16,300	805	20,700	889	4,380	164	4,140	148
Crabs, soft	124,125	6,040	108,375	5,970	86,250	4,713	115,475	6,878
Crabs, horseshoe	800,000	700	760,000	665	740,000	647	1,049,200	918
Lobsters	9,600	480	7,200	360	8,200	410	5,600	285
Oysters	1,034,250	64,671	1,179,500	73,605	1,097,040	70,134	1,227,324	73,863
Quahogs or hard clams	19,840	1,901	21,600	2,067	21,920	2,094	21,240	2,035
Terrapins	16,025	2,820	14,800	2,740	11,988	2,190	11,638	2,136
Turtles	22,000	1,540	21,000	1,470	18,000	1,260	19,000	1,295
Total	9,859,163	256,980	10,053,823	267,346	7,697,649	255,423	7,194,688	250,853

The following figures represent the number of bushels of certain products given in pounds in the foregoing table:

Products.	Quantity.			
	1889.	1890.	1891.	1892.
Crabs, soft ... number	372,375	325,125	258,750	346,425
Crabs, horseshoe ... do	400,000	380,000	370,000	528,600
Oysters ... bushels	147,750	168,500	156,720	175,332
Quahogs or hard clams ... do	2,480	2,700	2,740	2,655
Terrapins ... number	8,013	7,400	5,994	5,819

Statistics by counties.—The three counties of Delaware are all interested in the fisheries. Newcastle County borders on the Delaware River, Kent County partly on the river and partly on Delaware Bay, and Sussex County on the bay and ocean, as well as having an outlet to Chesapeake Bay through the Nanticoke River. The extent of the fisheries in each county is shown in the following tables.

Sussex County has the largest fishing population and the most invested capital, but the value of the fisheries of Kent County is greatest. The vessel fishing is practically confined to Kent County, and thus the larger part of the oyster product of the State becomes credited to that county, which also leads in the catch of squeteague. Newcastle County ranks second in the value of the yield. It leads the others in the output of shad and sturgeon. In Sussex County the catch of alewives, eels, and crabs is larger than elsewhere. This county also has, at Lewes and Seaford, respectively, important factories for the utilization of menhaden and oysters.

Statement by counties of the vessels, boats, apparatus, shore property, and cash capital employed in the fisheries of Delaware.

Designation.	Newcastle.						Kent.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	2	$1,440	1	$700	1	$700	23	$20,300	24	$20,825	25	$20,475
Tonnage	18.09		8.29		8.29		278.70		295.97		304.55	
Outfit		275		135		115		3,280		3,255		3,515
Vessels transporting	1	550	1	500	1	480						
Tonnage	5.73		5.73		5.73							
Outfit		65		75		75						
Boats	254	16.650	261	17,130	262	17,290	215	6,762	214	6,652	231	6,940
Apparatus:												
Dredges	8	130	4	85	4	85	92	1,940	96	2,025	100	2,110
Seines	9	590	9	570	9	570	56	4,190	56	4,190	55	4,135
Gill nets	234	23,130	241	23,795	244	24,145	208	4,942	208	4,708	212	4,775
Pound nets and weirs							4	200	3	150	10	300
Fyke nets	455	910	400	800	348	696	105	237	112	259	135	316
Cast nets							12	48	13	52	9	48
Eel pots	125	125	160	160	164	164						
Lines		5		5		5		9		8		8
Spears											25	15
Oyster tongs							75	300	72	288	85	334
Clam rakes							20	15	20	15	20	15
Shore property		4,300		5,300		5,300		2.500		2,500		3,000
Cash capital		8,000		10,000		10,000		1,500		1,500		2,000
Total		56,170		59,255		59,625		46,223		46,427		47,986

Designation.	Sussex.						Total.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing							25	$21, 740	25	$21, 525	26	$21, 175
Tonnage							296. 79		304. 26		312. 84	
Outfit								3, 555		3, 390		3, 630
Vessels transporting	14	$12, 000	15	$12, 750	16	$15, 100	15	12, 550	16	13, 250	17	15, 580
Tonnage	201. 00		218. 19		249. 87		206. 73		223. 92		255. 60	
Outfit		1, 800		1, 900		2. 080		1. 865		1, 975		2, 155
Boats	503	5, 553	471	5, 451	475	5, 524	972	28, 965	946	29, 233	968	29, 754
Apparatus:												
Dredges							100	2, 070	100	2, 110	104	2, 195
Seines	141	5, 560	138	5, 503	135	5, 378	206	10, 340	203	10, 263	199	10, 083
Gill nets	1, 145	5, 352	1, 137	5, 443	1, 147	5, 453	1, 587	33, 424	1, 586	33, 946	1, 603	34, 373
Pound nets and weirs	18	180	17	155	17	155	22	380	20	305	27	455
Fyke nets	57	208	55	202	57	208	617	1, 355	567	1, 261	540	1, 220
Cast nets							12	48	13	52	9	48
Crab nets	148	74	122	61	167	84	148	74	122	61	167	84
Eel pots	1, 660	646	1, 615	624	1, 712	663	1, 785	771	1, 775	784	1, 876	827
Lobster pots	40	100	40	100	21	53	40	100	40	100	21	53
Lines		7		7		7		21		20		20
Spears	170	85	170	85	170	85	170	85	170	85	195	100
Oyster tongs	31	124	31	124	37	148	106	424	103	412	122	482
Clam rakes	120	95	120	95	120	95	140	110	140	110	140	110
Shore property		39, 100		37, 000		40, 000		45, 900		44, 800		48, 300
Cash capital		33, 500		32, 900		35, 500		43, 000		44, 400		47, 500
Total		104, 384		102, 400		110, 533		206, 777		208, 082		218, 144

Statement by counties of the number of persons employed in the fisheries of Delaware.

Counties.	In vessel fisheries.			In shore fisheries.			On transporting vessels.			On shore, in factories, etc.			Total.		
	1890.	1891.	1892.	1890.	1891.	1892.	1890.	1891.	1892.	1890.	1891.	1892.	1890.	1891.	1892.
Kent	95	99	103	459	462	490	.....	.....	.....	5	5	6	559	566	599
Newcastle	8	4	4	351	360	367	2	2	2	22	25	25	383	391	398
Sussex	.....	.....	.....	859	831	835	39	41	44	339	401	463	1,237	1,273	1,342
Total	103	103	107	1,669	1,653	1,692	41	43	46	366	431	494	2,179	2,230	2,339

Statement by counties and species of the products of the fisheries of Delaware.

Species.	Kent.						Newcastle.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives	42,200	$1,050	42,940	$1,095	40,540	$1,048	383,600	$6,016	379,600	$6,040	345,520	$4,908
Catfish	23,000	1,344	24,600	1,411	25,640	1,475	33,900	2,122	32,760	1,998	29,960	1,820
Croakers	9,000	470	8,000	519	6,100	345	.....	.....	.....	.....	.....	.....
Drum	26,000	325	19,000	240	19,800	248	.....	.....	.....	.....	.....	.....
Eels	2,400	144	2,700	162	38,200	1,407	12,400	705	14,000	805	13,900	800
Mullet	5,000	150	4,500	135	4,500	135	.....	.....	.....	.....	.....	.....
Perch	34,200	2,317	35,920	2,427	36,340	2,441	33,300	2,510	33,500	2,523	33,200	2,514
Pike	4,000	244	3,900	237	4,000	247	4,750	320	4,600	304	4,600	304
Shad	175,700	10,110	155,875	9,102	126,811	7,494	1,314,600	43,104	1,166,025	44,230	837,732	42,516
Squeteague	2,398,600	14,128	881,200	11,918	644,640	11,579	.....	.....	.....	.....	.....	.....
Striped bass	36,120	4,709	33,280	4,493	34,157	4,516	33,050	4,069	34,230	4,065	37,930	4,619
Sturgeon	306,000	4,400	230,350	3,380	173,910	2,557	995,600	24,950	1,074,450	27,068	877,680	21,953
Suckers	4,850	230	5,400	249	5,180	247	2,400	180	2,150	147	2,150	147
Oysters	1,046,500	65,205	1,002,890	63,554	1,076,194	65,133	30,100	2,850	12,950	1,300	7,350	940
Quahogs or hard clams	2,560	256	2,400	240	2,280	228	.....	.....	.....	.....	.....	.....
Crabs, horseshoe	760,000	665	740,000	647	1,049,200	918	.....	.....	.....	.....	.....	.....
Terrapins	5,000	1,080	1,988	450	1,778	426	.....	.....	.....	.....	.....	.....
Turtles	13,000	910	10,000	700	11,500	805	.....	.....	.....	.....	.....	.....
Total	4,894,730	107,737	3,204,943	100,959	3,300,770	101,249	2,843,700	86,826	2,754,265	88,480	2,190,022	80,521

Species.	Sussex.						Total.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value	Pounds.	Value.
Alewives	401,250	$5,032	441,220	$5,277	462,830	$5,629	827,050	$12,098	863,760	$12,412	848,890	$11,585
Catfish	18,300	795	16,440	665	17,095	715	75,800	4,261	73,800	4,074	72,695	4,010
Croakers	47,900	2,525	34,460	1,761	33,090	1,566	56,900	2,995	42,460	2,280	39,190	1,911
Drum	8,000	100	11,000	140	11,220	145	34,000	425	30,000	380	31,020	393
Eels	211,300	8,275	206,800	8,000	217,020	8,428	226,100	9,124	223,500	8,967	269,120	10,635
Flounders	5,300	178	5,000	168	5,120	172	5,300	178	5,000	168	5,120	172
Kingfish	1,600	80	960	48	240	12	1,600	80	960	48	240	12
Menhaden	58,000	370	67,000	420	65,500	405	58,000	370	67,000	420	65,500	405
Mullet	31,400	966	34,400	990	35,800	1,069	36,400	1,116	38,900	1,125	40,300	1,204
Perch	184,250	11,437	186,435	11,189	141,875	9,064	251,750	16,264	255,855	16,139	211,415	14,019
Pike	15,710	966	16,150	1,007	17,240	1,053	24,460	1,530	24,950	1,548	25,840	1,604
Shad	306,918	13,598	178,296	11,367	145,826	10,245	1,797,218	66,812	1,500,196	64,699	1,110,369	60,255
Squeteague	703,400	5,717	283,530	5,606	192,870	4,785	3,102,000	19,845	1,164,730	17,524	837,510	16,364
Striped bass	38,050	5,654	27,400	4,200	42,955	6,307	107,220	14,432	94,910	12,758	115,042	15,442
Sturgeon	.....	.....	.....	.....	.....	.....	1,301,600	29,350	1,304,800	30,448	1,051,590	24,510
Suckers	3,000	90	3,500	105	1,600	48	10,250	500	11,050	501	8,930	442
Tautog	5,000	200	8,000	320	8,300	332	5,000	200	8,000	320	8,300	332
Other fish	20,700	889	4,380	164	4,140	148	20,700	889	4,380	164	4,140	148
Oysters	102,900	5,550	81,200	5,280	143,780	7,790	1,179,500	73,605	1,097,040	70,134	1,227,324	73,863
Lobsters	7,200	360	8,200	410	5,600	285	7,200	360	8,200	410	5,600	285
Quahogs or hard clams	19,040	1,811	19,520	1,854	18,960	1,807	21,600	2,067	21,920	2,094	21,240	2,035
Crabs, horseshoe	.....	.....	.....	.....	.....	.....	760,000	665	740,000	647	1,049,200	918
Crabs, soft	108,375	5,970	86,250	4,713	115,475	6,878	108,375	5,970	86,250	4,713	115,475	6,878
Terrapins	9,800	1,660	10,000	1,740	9,860	1,710	14,800	2,740	11,988	2,190	11,638	2,136
Turtles	8,000	560	8,000	560	7,500	490	21,000	1,470	18,000	1,260	19,000	1,295
Total	2,315,393	72,783	1,738,441	65,984	1,703,896	69,083	10,053,823	267,346	7,697,649	255,423	7,194,688	250,853

The catch by apparatus.—The quantity and value of the products taken by each kind of apparatus in each county are indicated in the following tables relating to the years 1890, 1891, and 1892. In the vessel fishery only oysters are taken, dredges being the apparatus employed. The yield in 1892 was 52,610 bushels, valued at $40,491. In the shore and boat fisheries, gill nets are of prime importance, taking more than half the fish credited to the State and nearly half the money returns. Shad and sturgeon are the prominent fish thus secured. Seines rank next to gill nets in the quantity and value of the catch, squeteague being the most important fish obtained. All other forms of apparatus—pound nets, fyke nets, cast nets, pots, etc.—take very small quantities of fish.

Statement by counties of the products of the vessel fisheries of Delaware.

Designation.	1890.		1891.		1892.	
	Bushels.	Value.	Bushels.	Value.	Bushels.	Value.
Oysters:						
Kent	57,300	$42,580	57,150	$42,350	51,560	$39,551
Newcastle	4,300	2,850	1,850	1,300	1,050	940
Total	61,600	45,430	59,000	43,650	52,610	40,491

Statement by counties, apparatus, and species of the yield of the shore fisheries of Delaware.

Apparatus and species.	Kent.						Newcastle.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Alewives	13,000	$335	13,840	$350	13,360	$338	221,200	$3,280	213,600	$3,140	193,600	$2,390
Catfish	4,000	200	3,600	180	3,640	182	12,200	790	13,000	785	12,500	745
Croakers	2,800	150	2,600	240	2,600	135	....	....	....	....	....	....
Drum	26,000	325	19,000	240	19,800	248	....	....	....	....	....	....
Perch	18,500	1,155	18,980	1,173	19,410	1,201	5,100	345	5,400	350	5,600	360
Pike	....	....	....	....	....	....	1,500	102	1,400	88	1,400	88
Shad	62,300	3,630	52,955	3,087	42,301	1,706	7,350	304	7,000	300	5,740	310
Squeteague	2,380,000	13,720	862,300	11,510	628,380	11,219	....	....	....	....	....	....
Striped bass	19,100	2,310	18,530	2,255	19,282	2,325	4,700	594	6,700	700	6,400	760
Suckers	3,000	120	3,400	136	2,980	119	2,100	165	1,800	130	1,800	130
Total	2,528,700	21,945	995,205	19,171	751,753	17,473	254,150	5,580	248,900	5,493	227,040	4,783
Gill nets:												
Alewives	28,000	685	28,100	720	26,180	685	162,400	2,736	166,000	2,900	151,920	2,518
Catfish	3,400	170	3,500	181	3,700	201	1,700	92	2,060	111	2,060	111
Croakers	6,200	320	5,400	279	3,500	210	....	....	....	....	....	....
Mullet	5,000	150	4,500	135	4,500	135	....	....	....	....	....	....
Perch	12,950	986	14,000	1,074	14,110	1,085	25,300	2,020	25,600	2,048	25,600	2,048
Pike	4,000	244	3,900	237	4,000	247	3,250	218	3,200	216	3,200	216
Shad	113,400	6,489	102,920	6,015	84,510	5,788	1,307,250	42,800	1,159,025	43,930	831,992	42,206
Squeteague	3,600	108	3,600	108	3,060	100	....	....	....	....	....	....
Striped bass	14,270	2,006	11,960	1,845	13,475	1,975	26,350	3,255	25,630	3,155	29,580	3,640
Sturgeon	306,000	4,400	230,350	3,380	173,910	2,557	995,600	24,950	1,074,450	27,068	877,680	21,953
Suckers	1,600	100	1,800	105	2,000	120	300	15	350	17	350	17
Total	498,420	15,649	410,030	14,079	332,885	13,103	2,522,150	76,086	2,456,315	79,445	1,922,382	72,709
Pound nets and weirs:												
Alewives	1,200	30	1,000	25	1,000	25	....	....	....	....	....	....
Catfish	500	40	400	32	100	8	....	....	....	....	....	....
Perch	700	63	640	55	220	15	....	....	....	....	....	....
Striped bass	2,000	300	1,750	265	520	95	....	....	....	....	....	....
Total	4,400	433	3,790	377	1,840	143	....	....	....	....	....	....
Fyke nets:												
Catfish	5,400	324	6,500	390	7,800	468	16,000	960	13,700	822	11,400	684
Eels	2,400	144	2,700	162	3,200	182	3,900	195	3,500	175	3,100	155
Perch	1,450	77	1,700	89	2,000	104	2,900	145	2,500	125	2,000	106
Striped bass	250	33	240	32	280	37	1,000	100	900	90	750	75
Suckers	250	10	200	8	200	8	....	....	....	....	....	....
Total	9,750	588	11,340	681	13,480	799	23,800	1,400	20,600	1,212	17,250	1,020

Statement by counties, apparatus, and species of the yield of the shore fisheries of Delaware—Continued.

Apparatus and species	Kent.						Newcastle.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Cast nets:												
Catfish	9,300	$560	9,600	$578	9,400	$566						
Pots:												
Eels							8,500	$519	10,500	$630	10,800	$645
Spears:												
Eels					35,000	1,225						
Lines:												
Catfish	1,000	50	1,000	50	1,000	50	4,000	280	4,000	280	4,000	280
Perch	600	36	600	36	600	36						
Squeteague	15,000	300	15,300	300	13,260	260						
Striped bass	500	60	800	96	600	84	1,000	120	1,000	120	1,200	144
Total	17,100	446	17,700	482	15,460	430	5,000	400	5,000	400	5,200	424
Miscellaneous:												
Oysters	645,400	22,625	602,840	21,204	715,274	25,582						
Clams	2,560	258	2,400	240	2,280	228						
Crabs, horseshoe	760,000	665	740,000	647	1,049,200	918						
Terrapins	5,000	1,080	1,988	450	1,778	426						
Turtles	13,000	910	10,000	700	11,560	805						
Total	1,425,960	25,536	1,357,228	23,241	1,780,032	27,959						
Grand total	4,493,630	65,157	2,804,893	58,609	2,939,850	61,698	2,813,600	83,976	2,741,315	87,180	2,182,672	79,581

Apparatus and species.	Sussex.						Total.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Alewives	291,100	$3,716	288,200	$3,688	315,800	$4,091	525,300	$7,331	515,640	$7,178	522,760	$6,819
Catfish	7,300	335	4,400	170	4,600	185	23,500	1,325	21,000	1,135	20,740	1,112
Croakers	13,500	685	11,300	571	20,200	918	16,300	835	13,900	811	22,800	1,053
Drum	8,000	100	11,000	140	11,220	145	34,000	425	30,000	380	31,020	393
Flounders	5,300	178	5,000	168	5,120	172	5,300	178	5,000	168	5,120	172
Menhaden	8,000	40	8,000	40	10,000	50	8,000	40	8,000	40	10,000	50
Mullet	3,800	114	3,800	114	3,400	102	3,800	114	3,800	114	3,400	102
Perch	112,650	6,595	119,400	6,697	62,480	3,876	136,250	8,095	143,780	8,220	87,490	5,437
Pike	6,400	470	6,400	470	6,300	465	7,900	572	7,800	558	7,700	553
Shad	107,998	5,096	55,419	3,753	45,755	3,544	177,648	9,030	115,374	7,140	93,796	5,560
Squeteague	657,600	4,373	252,600	4,678	174,410	4,229	3,037,600	18,093	1,114,900	16,188	802,790	15,448
Striped bass	29,300	4,305	19,620	3,003	33,555	4,885	53,100	7,209	44,850	5,958	59,237	7,970
Suckers							5,100	285	5,200	266	4,780	249
Other fish	8,500	425					8,500	425				
Total	1,259,448	26,432	785,139	23,492	692,840	22,662	4,042,298	53,957	2,029,244	48,156	1,671,633	44,918
Gill nets:												
Alewives	106,800	1,299	141,000	1,529	136,000	1,482	297,200	4,720	335,100	5,149	314,100	4,685
Catfish	6,800	250	7,100	259	6,600	244	11,900	512	12,660	551	12,360	556
Croakers	34,400	1,840	23,160	1,190	12,890	648	40,600	2,160	28,560	1,469	16,390	858
Kingfish	1,600	80	960	48	240	12	1,600	80	960	48	240	12
Menhaden	50,000	330	59,000	380	55,500	355	50,000	330	59,000	380	55,500	355
Mullet	27,600	852	30,600	876	32,400	967	32,600	1,002	35,100	1,011	36,900	1,102
Perch	58,200	4,092	53,915	3,780	66,170	4,455	96,450	7,098	93,515	6,902	105,880	7,588
Pike	8,760	463	9,550	507	10,330	551	16,010	925	16,650	960	17,530	1,014
Shad	196,820	8,439	120,385	7,473	97,727	6,580	1,617,470	57,719	1,382,330	57,418	1,014,229	54,574
Squeteague	29,300	849	19,930	598	13,660	412	32,900	957	23,530	706	16,660	512
Striped bass	8,350	1,289	7,480	1,152	8,840	1,346	48,970	6,550	45,070	6,152	51,895	6,961
Sturgeon							1,301,600	29,350	1,304,800	30,448	1,051,590	24,510
Suckers	3,000	90	3,500	105	1,600	48	4,900	205	5,650	227	3,950	185
Other fish	6,500	325	500	30	400	24	6,500	325	500	30	400	24
Total	538,130	20,198	477,080	17,927	442,357	17,124	3,558,700	111,933	3,343,425	111,451	2,697,624	102,936
Pound nets and weirs:												
Alewives	3,350	17	12,020	60	11,030	56	4,550	47	13,020	85	12,030	81
Catfish	4,200	210	2,940	136	3,095	146	4,700	250	3,340	168	3,195	154
Perch	9,400	470	5,650	279	4,795	236	10,100	533	6,290	334	5,015	251
Pike	550	33	500	30	610	37	550	33	500	30	610	37
Shad	1,050	31	1,491	80	1,419	71	1,050	31	1,491	80	1,419	71
Striped bass					160	16	2,000	300	1,750	265	680	111
Other fish	900	45	1,500	75	1,170	57	900	45	1,500	75	1,170	57
Total	19,450	806	24,101	660	22,279	619	23,850	1,239	27,891	1,037	24,119	762

Statement by counties, apparatus, and species of the yield of the shore fisheries of Delaware—Continued.

Apparatus and species.	Sussex.						Total.					
	1890.		1891.		1892.		1890.		1891.		1892.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Fyke nets:												
Catfish			2,000	$100	2,800	$140	21,400	$1,284	22,200	$1,312	22,000	$1,292
Eels							6,300	339	6,200	337	6,300	337
Perch	4,000	$280	7,470	433	8,430	497	8,350	502	11,670	647	12,430	707
Shad	1,050	32	1,001	61	925	50	1,050	32	1,001	61	925	50
Striped bass	400	60	300	45	400	60	1,650	193	1,440	167	1,430	172
Suckers							250	10	200	8	200	8
Other fish	4,800	94	2,380	59	2,570	67	4,800	94	2,380	59	2,570	67
Total	10,250	466	13,151	698	15,125	814	43,800	2,454	45,091	2,591	45,855	2,633
Cast nets:												
Catfish							9,300	560	9,600	578	9,400	566
Pots:												
Eels	91,300	3,715	86,800	3,440	91,420	3,644	99,800	4,225	97,300	4,070	102,220	4,289
Lobsters	7,200	360	8,200	410	5,600	285	7,200	360	8,200	410	5,600	285
Total	98,500	4,075	95,000	3,850	97,020	3,929	107,000	4,585	105,500	4,480	107,820	4,574
Spears:												
Eels	120,000	4,560	120,000	4,560	125,600	4,784	120,000	4,560	120,000	4,560	160,600	6,009
Lines:												
Catfish							5,000	330	5,000	330	5,000	330
Perch							600	36	600	36	600	36
Squeteague	16,500	495	11,000	330	4,800	144	31,500	795	26,300	630	18,060	404
Striped bass							1,500	180	1,800	216	1,800	228
Tautog	5,000	200	8,000	320	8,300	332	5,000	200	8,000	320	8,300	332
Total	21,500	695	19,000	650	13,100	476	43,600	1,541	41,700	1,532	33,760	1,330
Miscellaneous:												
Oysters	102,900	5,550	81,200	5,280	143,780	7,790	748,300	28,175	684,040	26,484	859,054	33,372
Clams	19,040	1,811	19,520	1,854	18,960	1,807	21,600	2,067	21,920	2,094	21,240	2,035
Crabs, horseshoe							760,000	665	740,000	647	1,049,200	918
Crabs, soft	108,375	5,970	86,250	4,713	115,475	6,878	108,375	5,970	86,250	4,713	115,475	6,878
Terrapins	9,800	1,660	10,000	1,740	9,860	1,710	14,800	2,740	11,988	2,190	11,638	2,136
Turtles	8,000	560	8,000	560	7,500	490	21,000	1,470	18,000	1,260	19,000	1,295
Total	248,115	15,551	204,970	14,147	295,575	18,675	1,674,075	41,087	1,562,198	37,388	2,075,607	46,634
Grand total	2,315,393	72,783	1,738,441	65,984	1,703,896	69,083	9,622,623	221,916	7,284,649	211,773	6,826,418	210,362

Statistics of special industries.—The following table shows the extent of the wholesale oyster-opening trade of Seaford, located on the Nanticoke River, a tributary of Chesapeake Bay. While the business is small as compared with that in the adjoining State of Maryland, it is quite important in proportion to the general extent of the fishing industry of Delaware.

Summary of the oyster-packing industry of Delaware.

Designation.	1890.	1891.
Number of firms	4	4
Shore employés	267	251
Value of plants	$19, 100	$19, 100
Cash capital	$20, 800	$20, 000
Wages to employés	$28, 181	$24, 275
Oysters utilized ... bushels	270, 800	228, 600
Cost	$148, 940	$125, 730
Opened oysters sold ... gallons	174, 444	155, 000
Value	$184, 704	$166, 275

The business of preparing fertilizer from king crabs or horseshoe crabs is engaged in by one firm located in Kent County. Five or six men are regularly employed in making the scrap. The extent of this industry is shown for four years in the following table:

Summary of the king-crab industry of Delaware.

Items.	1889.	1890.	1891.	1892.
Number of crabs utilized	200, 000	190, 000	185, 000	262, 300
Cost	$700	$665	$647	$918
Number of tons of fertilizer made	100	94	97	134
Value	$2, 850	$2, 800	$2, 900	$4, 020

A very extensive wholesale trade in sturgeon, caviar, and shad is carried on in Newcastle County by firms who purchase the round fish directly from the fishermen and ship the products to the markets. In the case of sturgeon, the fish are dressed before shipment and caviar is prepared from their roe. The extent and principal features of this trade for four years are given in the following table. In other parts of the State the fishermen usually ship their own sturgeon and shad without the intervention of a wholesale dealer.

Summary of the wholesale sturgeon and shad trade of Delaware.

Items.	1889.	1890.	1891.	1892.
Number of firms	4	5	6	6
Value of plants	$4,150	$4,300	$5,300	$5,300
Cash capital	$8,000	$8,000	$10,000	$10,000
Number of men employed:				
White	12	14	16	16
Colored	8	8	9	9
Amount of wages paid	$2,160	$2,440	$2,480	$2,300
Number of sturgeon handled	3,900	3,740	4,035	3,362
Weight (round) ......pounds	663,000	635,800	685,900	578,540
Value to fishermen	$16,080	$17,850	$19,368	$12,103
Dressed sturgeon sold ......pounds	370,500	355,300	383,325	313,390
Value as sold	$13,400	$12,800	$13,920	$11,425
Caviar prepared ......pounds	105,000	103,000	98,280	59,140
Value as sold	$16,480	$26,150	$20,370	8,565
Number of shad handled	140,000	190,000	175,000	115,500
Value to fishermen	$21,000	$21,000	$23,500	$21,550
Value as sold	$28,000	$30,500	$31,250	$26,780

FISHERIES OF MARYLAND.

General importance of the industry.—In the items of persons employed, capital invested, and quantity and value of products, Maryland surpasses all the other States of this region. The fishing population also exceeds that of any other State, although the value of the catch and the investment are less than in Massachusetts.

The large extent of the fisheries of Maryland is due, in great measure, to the very favorable physical conditions. The State has been computed to have 2,170 miles of frontage on the ocean, bays, and navigable rivers. The shape of the State is such that a large part of it is brought into close relation, if not in actual contact, with waters containing commercial products, and few settlements in any of the tide-water counties are distant more than 5 or 6 miles from the water. In addition to an exceedingly tortuous coast line which increases the water area, Maryland has jurisdiction over a large part of Chesapeake Bay—the largest inland body of salt water on the coast of the United States—and has within its boundaries or on its borders several very important rivers, chief of which are the Potomac, Susquehanna, Patuxent, and Choptank. To the foregoing advantageous physical features is added an abundance of resident and migratory fish, crabs, terrapins, and the most productive oyster beds in the world.

Maryland partakes of the same advantage of proximity to excellent markets which is enjoyed by the other States of this section. The accessibility of Washington and Baltimore to steam and sail vessels, and the readiness with which the products may also be sent from the fishing-grounds by rail to these cities, as well as to the larger cities to the north and east, are important factors in the development of the fisheries.

As is well known, this State leads all others in the extent of its oyster fishery, which represents over 81 per cent of the value of the fishery products. This, however, is not the only branch in which the State is preeminent. The crab fishery, the terrapin fishery, the alewife fishery, the catfish fishery, the striped-bass fishery, the white-perch

fishery, the yellow-perch fishery, and the pike fishery are all more valuable than in any other State. The shad fishery ranks after that of New Jersey in importance, and the yield of bluefish, eels, menhaden, and squeteague is very large. This State is noteworthy for having the largest fleet of vessels engaged in the fisheries and the most extensive oyster packing and canning business.

Summarized statistics.—From the following series of tables it will be seen that in 1890 Maryland had a fishing population of 40,452, an invested capital of $7,649,904, and products valued at $6,019,165. In the next year the fishery employés numbered 39,944, the investment was $7,466,718, and the gross receipts of the fishermen were $6,460,759.

The number of persons engaged in vessel fisheries in 1891 was 8,342, the number of shore and boat fishermen was 19,867, and the number of shoresmen was 11,735.

The fishing fleet consisted of 1,627 vessels, having a tonnage of 34,183, valued, with their outfits, at $1,838,249. The 9,825 boats had a value of $579,488. The apparatus of capture comprised 536 seines, with a value of $76,780; 733 pound nets, worth $68,655; 11,976 gill nets, valued at $97,289; 17,902 dredges and tongs, having a value of $198,920; and other apparatus to the value of $53,555.

The value of the oyster output in 1891 was $5,295,866. The shad catch was worth $211,575, and the yield of alewives $131,245. Crabs ranked next to oysters, being worth $303,716. The fish of which the largest quantity was taken were menhaden, but these were much less valuable than the shad, alewives, and striped bass.

Persons employed in the fisheries of Maryland.

How engaged.	1890.	1891.
In vessel fisheries	7,121	6,892
In shore fisheries	19,590	19,867
On transporting vessels	1,266	1,450
On shore, in factories, canneries, etc	12,475	11,735
Total	40,452	39,944

Vessels, boats, apparatus, shore property, and cash capital employed in the fisheries of Maryland.

Designation.	1890.		1891.	
	Number.	Value.	Number.	Value.
Vessels fishing	1,251	$912,392	1,225	$876,705
Tonnage	22,072		21,033	
Outfit		328,115		331,709
Vessels transporting	354	536,485	402	570,150
Tonnage	11,805		13,150	
Outfit		54,208		59,685
Boats	9,815	575,183	9,825	579,488
Apparatus—vessel fisheries:				
Seines	14	6,900	15	8,450
Dredges	2,700	115,992	2,419	111,374
Tongs	439	3,887	494	4,287
Apparatus—shore fisheries:				
Seines	529	70,790	521	68,330
Pound nets	808	74,730	733	68,655
Gill nets	12,641	98,902	11,976	97,289
Fyke nets	10,485	39,400	10,358	38,924
Trammel nets	25	2,785	23	2,725
Weirs	278	3,151	272	3,123
Pots	5,113	4,446	4,636	4,013
Lines		2,069		2,272
Dredges and scrapes	2,088	11,952	2,068	10,509
Tongs	12,433	68,810	12,921	72,750
Minor apparatus	1,439	2,387	1,503	2,498
Shore property		2,467,800		2,446,327
Cash capital		2,269,520		2,107,455
Total		7,649,904		7,466,718

Products of the fisheries of Maryland.

Species.	1890.		1891.		Species.	1890.		1891.	
	Pounds.	Value.	Pounds.	Value		Pounds.	Value.	Pounds.	Value.
Alewives	19, 766, 994	$143, 793	17, 418, 850	$131, 245	Spots and croakers	272, 505	$11, 986	273, 283	$12, 119
Butter-fish	30, 226	738	31, 955	785	Squeteague	687, 173	24, 681	750, 465	25, 902
Bluefish	460, 160	21, 266	516, 364	22, 761	Striped bass	1, 365, 928	105, 759	1, 264, 693	97, 770
Carp	26, 920	657	27, 628	780	Sturgeon	99, 932	3, 313	72, 445	2, 343
Catfish	1, 327, 552	46, 675	1, 296, 752	45, 502	Suckers	293, 667	7, 714	285, 238	7, 533
Eels	791, 282	33, 005	792, 044	32, 919	Other fish	449, 463	14, 899	438, 683	14, 561
Flounders	32, 378	970	33, 443	1, 008	Crabs, hard	2, 388, 099	31, 723	2, 776, 898	37, 460
Menhaden	27, 969, 556	57, 180	30, 952, 120	65, 307	Crabs, soft	4, 056, 110	228, 690	4, 828, 872	266, 256
Mullet	101, 300	2, 901	101, 540	2, 974	Crawfish	6, 250	562	7, 350	695
Perch, white	1, 150, 296	58, 898	1, 109, 273	57, 038	Shrimp	7, 556	3, 720	8, 044	3, 960
Perch, yellow	1, 369, 551	46, 981	1, 385, 352	48, 040	Oysters	73, 150, 609	4, 854, 746	69, 615, 406	5, 295, 866
Pike	576, 557	35, 836	563, 264	35, 261	Quahogs	148, 800	8, 400	147, 760	8, 226
Sea bass	123, 320	4, 900	113, 370	4, 544	Terrapins	87, 701	21, 852	89, 780	22, 333
Shad	7, 127, 486	242, 909	6, 224, 873	211, 575	Turtles	3, 980	227	4, 060	231
Sheepshead	3, 430	426	3, 185	396					
Spanish mackerel	28, 195	3, 758	44, 837	5, 369	Total	143, 905, 576	6, 019, 165	141, 177, 827	6, 460, 759

A better conception of the quantities of certain products taken in this State may be obtained from the following table, in which the units of measure given correspond with those usually adopted in commerce:

Products.	Quantity.	
	1890.	1891.
Crabs, hard .... number	7, 014, 297	8, 330, 694
Crabs, soft .... do	12, 168, 330	14, 486, 616
Crawfish .... do	75, 000	88, 200
Oysters .... bushels	10, 450, 087	9, 945, 058
Clams .... do	18, 600	18, 470
Terrapins .... number	43, 850	44, 890

Extent of the fisheries in each county.—The detailed statistics given in the following tables show the importance and principal phases of the fishing industry in each county in Maryland having commercial fisheries. The data relate to the years 1890 and 1891. There are 16 counties in the State bordering on important bodies of water. One of these, Worcester, abuts on the ocean; the others are on Chesapeake Bay and the rivers already mentioned. The District of Columbia will be considered as a part of Maryland and will be included in the tables for that State.

Each of 11 counties of Maryland has over 1,000 persons engaged in the fishing industry. Baltimore County, owing to its extensive vessel fishery and oyster houses, has the largest number of fishery employés; in 1890 there were 12,153 and in 1891 11,052. No other county in the United States has so large a number of persons engaged in this industry, and only three States besides Maryland, viz, Massachusetts, Virginia, and New York, have such a numerous fishing population. Somerset County has a larger number of persons engaged in actual fishing than Baltimore, and in this respect surpasses any other single county in the United States with the probable exception of Essex County, Massachusetts. Dorchester, Talbot, Anne Arundel, St. Mary, and Wicomico counties also have a relatively large fishing population.

Baltimore County has the same prominence in the amount of its fishery investment that it holds as regards the persons employed. Of the $4,357,488 credited to that county, however, $3,752,001 represented the shore industries, and only $605,487 the fisheries proper. The aggregate investment in Somerset County was $1,221,669, of which $878,639 was directly devoted to fishing property. While Baltimore County had 387 vessels employed in the fisheries, Somerset County had 578, a much larger number than is found in any other county in the country. The other counties referred to as having the largest number of fishermen also have the largest investments.

After Somerset comes Dorchester with $596,546, Anne Arundel with $223,218, Talbot with $271,899, Wicomico with $141,126, and St. Mary with $121,060.

More than one-third the value of the products of the fisheries of Maryland in 1891 represented the operations of the fishermen of Somerset County, whose receipts were $2,342,419. Of this sum, $2,099,352 is to be credited to oysters, and more than half the remainder, or $177,269, to crabs, in both of which products this county excels all others. Next to Somerset in the value of its fisheries is Dorchester County, $913,528 accruing to its fishermen in 1891, of which $825,982 was from the sale of oysters.

Numerous other counties have very valuable fisheries, as will be seen from the table. Those having products valued at over $200,000 in 1891 were Baltimore with $637,312, Talbot with $395,140, Anne Arundel with $394,847, St. Mary with $368,469, Wicomico with $293,880, Queen Anne with $247,529, Calvert with $203,684, and Kent with $200,044.

Besides oysters and crabs, which are taken in largest quantities in Somerset County, the counties ranking first in the value of other important products are as follows: Harford, alewives and shad; Somerset, menhaden; Baltimore, striped bass; Worcester, squeteague; Kent, white perch and yellow perch; Talbot, terrapin.

Statement by counties of the number of persons employed in the fisheries of Maryland.

Counties.	In vessel fisheries.		On transporting vessels.		In shore fisheries.		On shore, in factories, etc.		Total.	
	1890.	1891.	1890.	1891.	1890.	1891.	1890.	1891.	1890.	1891.
Anne Arundel	193	215	83	78	1,832	1,921	428	410	2,536	2,624
Baltimore	2,390	2,015	432	552	595	608	8,736	7,877	12,153	11,052
Calvert	100	130	96	84	1,113	1,169			1,309	1,383
Caroline					348	328	13	13	361	341
Cecil					803	783	85	85	888	868
Charles			4		486	488			490	488
Dorchester	1,301	1,309	186	198	2,228	2,182	789	745	4,504	4,434
Harford					868	906	135	215	1,003	1,121
Kent	29	11	73	87	840	916	10	10	952	1,024
Prince George					206	143			206	143
Queen Anne	12	12	44	45	846	1,025			902	1,082
St. Mary	58	85	70	74	1,888	2,007			2,016	2,166
Somerset	2,768	2,862	217	266	3,059	3,015	1,488	1,613	7,532	7,756
Talbot	166	158	11	11	2,327	2,335	716	632	3,220	3,136
Wicomico	97	88	39	46	1,336	1,285	75	135	1,547	1,554
Worcester	7	7			654	586			661	593
District of Columbia			11	9	161	170			172	179
Total	7,121	6,892	1,266	1,450	19,590	19,867	12,475	11,735	40,452	39,944

Statement by counties of the vessels, boats, apparatus, shore property, and cash capital employed in the fisheries of Maryland.

Designation.	Caroline.				Cecil.				Charles.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	No.	Value	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels transporting									1	$1,000		
Tonnage									26			
Outfit										145		
Boats	208	$3,029	197	$2,848	346	$11,782	317	$11,141	280	12,570	276	$12,040
Apparatus—shore fisheries:												
Seines	27	2,580	29	2,775	27	4,870	25	4,750	5	1,350	5	1,300
Pound nets	31	2,170	24	1,560	161	12,885	127	10,170	90	9,950	87	9,725
Gill nets	1,940	9,370	1,785	8,755	389	11,116	384	10,390	123	8,597	123	8,465
Fyke nets	237	2,214	239	2,374	2,836	5,732	2,923	5,626				
Trammel nets					8	1,000	8	1,000				
Weirs	23	345	25	375	31	205	30	200				
Lines		37		35		20		22		38		35
Tongs									188	996	192	1,020
Minor apparatus						30		32		13		11
Shore property		6,900		7,000		18,700		18,000		5,500		5,465
Cash capital		4,500		4,500								
Total		31,145		30,222		66,340		61,331		40,159		38,061

Statement by counties of the vessels, boats, apparatus, shore property, and cash capital employed in the fisheries of Maryland—Continued.

Designation.	Anne Arundel.				Baltimore.				Calvert.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	55	$28, 840	66	$35, 405	279	$278, 813	235	$228, 645	21	$20, 650	28	$28, 150
Tonnage	459		562		8, 937		7, 591		345		487	
Outfit		6, 135		6, 755		105, 944		86, 352		3, 815		3, 785
Vessels transporting	31	32, 785	28	27, 050	123	201, 875	152	219, 675	25	51, 650	22	49, 175
Tonnage	536		492		4, 891		5, 742		933		894	
Outfit		2, 555		2, 233		14, 614		16, 899		3, 870		3, 465
Boats	844	49, 850	874	52, 890	245	9, 551	255	9, 750	547	27, 033	586	27, 006
Apparatus—vessel fisheries:												
Seines					9	3, 500	5	2, 150				
Dredges and scrapes	20	750	14	550	556	25, 020	470	21, 150	26	1, 040	38	1, 235
Tongs	130	1, 300	175	1, 750					20	200	25	250
Apparatus—shore fisheries:												
Seines	23	1, 495	24	1, 560	69	11, 970	72	12, 505	15	1, 050	16	1. 120
Pound nets	45	4, 950	44	4, 840	13	1, 240	15	1, 420	16	2, 400	18	2, 700
Gill nets	76	266	72	252	28	273	33	303	152	532	158	553
Fyke nets	20	360	22	396	1, 666	5, 979	1, 781	6, 113				
Weirs					20	160	21	165				
Pots	320	320	343	343	155	122	167	134				
Lines		430		440		30		32		50		50
Dredges and scrapes	129	645	126	630					43	1, 290	7	210
Tongs	1, 697	10, 182	1, 782	10, 692					931	9, 310	1, 052	10, 520
Minor apparatus		86		88		185		194		6		7
Shore property		38, 347		36, 844		2, 064, 426		2, 033, 001		689		736
Cash capital		40, 500		40, 500		1, 899, 000		1, 719, 000				
Total		219, 796		222, 218		4, 622, 702		4, 357, 488		123, 585		128, 962

Designation.	Dorchester.				Harford.				Kent.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	298	$150, 388	299	$151, 150					3	$2, 600	2	$1, 075
Tonnage	3, 069		3, 109						95		31	
Outfit		61, 387		64, 762						1, 050		352
Vessels transporting	42	92, 125	45	98 100					32	15, 350	40	20, 350
Tonnage	1, 819		1, 982						471		637	
Outfit		10, 175		10, 735						3, 714		3, 873
Boats	1, 376	72, 779	1, 312	70, 517	218	$8, 705	230	$9, 295	682	26, 269	624	27, 859
Apparatus—vessel fisheries:												
Seines			2	1, 100								
Dredges and scrapes	610	27, 218	612	26, 671					6	395	2	125
Tongs	72	589	108	823							2	12
Apparatus—shore fisheries:												
Seines	51	4, 335	46	4, 140	15	15, 320	16	14, 200	23	2, 310	22	2, 170
Pound nets	127	8, 255	108	5, 100					51	3, 770	55	3, 940
Gill nets	2, 750	11, 410	2, 425	9, 740	217	6, 536	296	8, 860	338	4, 740	336	4, 590
Fyke nets	1, 700	7, 994	1, 470	6, 653	1, 230	4, 325	1, 140	4, 010	214	3, 968	211	3, 856
Trammel nets					17	1, 785	15	1, 725				
Weirs	87	1, 310	85	1, 285					4	50	4	47
Pots	1, 440	1, 296	1, 125	1, 013	430	473	415	456	68	82	90	110
Lines		245		307		55		53		38		39
Dredges and scrapes	360	1, 935	365	1, 950								
Tongs	1, 425	7, 125	1, 335	6, 675					687	3, 435	797	4, 305
Minor apparatus		675		675						48		48
Shore property		56, 965		57, 450		28, 824		28, 532		10, 396		10, 440
Cash capital		78, 350		77, 400						4, 800		4, 800
Total		594, 556		596, 546		66, 023		67, 131		83, 015		87, 991

Statement by counties of the vessels, boats, apparatus, shore property, and cash capital employed in the fisheries of Maryland—Continued.

Designation.	Prince George.				Queen Anne.				St. Mary.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing					1	$1,000	1	$1,000	11	$5,925	19	$13,225
Tonnage					23		23		128		229	
Outfit						575		550		1,685		2,490
Vessels transporting					17	10,850	18	14,400	19	26,000	21	23,650
Tonnage					280		329		532		530	
Outfit						2,182		2,336		2,543		2,742
Boats	81	$2,065	76	$1,640	504	26,348	594	31,844	931	48,379	1,001	51,924
Apparatus—vessel fisheries:												
Seines					1	600	1	600				
Dredges and scrapes									22	933	32	1,355
Tongs											3	20
Apparatus—shore fisheries:												
Seines	18	3,000	17	1,360	26	3,620	24	3,495	19	1,455	18	1,380
Pound nets	7	700	6	690	11	960	9	710	56	9,950	59	10,450
Gill nets	114	479	110	470	373	1,985	335	1,795	137	499	144	556
Fyke nets					52	865	74	1,435				
Weirs					9	45	9	45				
Pots					158	155	160	157	180	90	210	105
Lines		76		82		32		74		40		40
Dredges and scrapes									54	1,595	37	1,025
Tongs					827	4,135	1,013	5,065	1,305	9,090	1,461	10,390
Minor apparatus		90		90		43		70		90		90
Shore property		515		475		3,471		3,829		1,589		1,618
Cash capital						1,300		1,300				
Total		6,925		4,717		58,164		68,705		109,863		121,060

Designation.	Somerset.				Talbot.				Wicomico.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	522	$387,676	518	$383,805	43	$19,900	41	$18,875	15	$15,425	13	$14,225
Tonnage	8,280		8,332		374		377		343		305	
Outfit		133,780		153,453		8,360		8,310		5,299		4,815
Vessels transporting	49	80,890	60	91,150	3	5,200	3	5,200	8	16,700	10	19,500
Tonnage	1,823		2,005		101		101		332		384	
Outfit		11,250		13,822		600		590		2,035		2,495
Boats	1,482	150,125	1,457	149,460	1,098	74,440	1,115	72,685	535	37,140	513	35,573
Apparatus—vessel fisheries:												
Seines	4	2,800	7	4,600								
Dredges and scrapes	1,281	54,986	1,134	54,866	88	3,760	83	3,680	41	1,890	34	1,742
Tongs	208	1,713	172	1,344	2	15	2	15				
Apparatus—shore fisheries:												
Seines	13	1,100	11	950	41	6,355	47	7,755	33	3,270	28	2,765
Pound nets	38	2,850	21	1,365	86	8,600	78	8,580	63	4,725	59	4,720
Gill nets	1,885	9,425	1,625	8,125	2,136	20,560	2,286	22,272	1,010	6,255	900	5,500
Fyke nets	1,172	2,480	1,179	2,595	607	2,614	579	2,888	726	2,791	708	2,867
Weirs	28	356	28	350	27	248	19	216	36	380	36	380
Pots	1,075	967	940	846	325	293	310	287	362	348	296	272
Lines		225		231		348		433		371		367
Dredges and scrapes	987	3,437	991	3,449	325	1,910	332	1,985	190	1,140	210	1,260
Tongs	2,247	7,932	2,249	7,938	1,875	9,375	1,890	9,450	975	5,850	945	5,670
Minor apparatus		260		290		513		515		335		375
Shore property		148,257		151,780		57,880		61,855		13,100		18,600
Cash capital		176,350		191,250		48,220		46,305		13,500		20,000
Total		1,176,769		1,221,669		269,191		271,899		130,554		141,126

Statement by counties of the vessels, boats, apparatus, shore property, and cash capital employed in the fisheries of Maryland—Continued.

Designation.	Worcester.				District of Columbia.				Total.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	3	$1,175	3	$1,150					1,251	$912,392	1,225	$876,705
Tonnage	21		26						22,074		21,072	
Outfit		85		85						328,115		331,709
Vessels transporting					4	$2,150	3	$1,900	354	536,485	402	570,150
Tonnage					61		55		11,805		13,151	
Outfit						525		495		54,208		59,685
Boats	367	12,683	322	10,301	71	2,435	76	2,715	9,815	575,183	9,825	579,488
Apparatus—vessel fisheries:												
Seines									14	6,900	15	8,450
Dredges and scrapes									2,700	115,992	2,419	111,374
Tongs	7	70	7	70					439	3,887	494	4,287
Apparatus—shore fisheries:												
Seines	116	4,535	115	4,430	8	2,175	6	1,675	529	70,790	521	68,330
Pound nets					13	1,325	23	2,475	808	74,730	733	68,655
Gill nets	928	4,384	921	4,288	45	2,475	43	2,375	12,641	98,902	11,976	97,289
Fyke nets	25	80	32	111					10,485	39,400	10,358	38,924
Trammel nets									25	2,785	23	2,725
Weirs	13	52	15	60					278	3,151	272	3,123
Pots	600	300	580	290					5,113	4,446	4,636	4,013
Lines		34		32						2,069		2,272
Dredges and scrapes									2,088	11,952	2,068	10,509
Tongs	276	1,380	205	1,025					12,433	68,810	12,921	72,750
Minor apparatus		13		13						2,387		2,498
Shore property		11,596		10,067		645		635		2,467,800		2,446,327
Cash capital		3,000		2,400						2,269,520		2,107,455
Total		39,387		34,322		11,730		12,270		7,649,904		7,466,718

Statement by counties and species of the yield of the fisheries of Maryland.

Species.	Somerset.				Talbot.				Wicomico.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives	377,000	$1,883	331,500	$1,656	715,680	$4,208	635,564	$3,832	1,788,300	$8,741	1,675,360	$8,179
Bluefish	30,200	1,026	37,200	1,192	59,600	2,980	53,400	2,658	34,600	1,712	31,950	1,577
Catfish	35,200	1,543	34,420	1,489	96 900	2,521	106,000	2.796	214,090	8,158	198.763	7,544
Eels	70,010	2,780	62,010	2,458	48,960	1,732	44,775	1,631	84,070	3,318	111,220	4,458
Menhaden	12,544,600	25,950	15,481,100	30,578	98,200	230	91,100	209				
Mullet	16,300	326	15,900	324								
Perch, white	33,150	1,326	30,930	1,237	64,850	2,519	63,305	2,463	80 965	4,305	74.885	3,936
Perch, yellow	33,500	1,005	32.940	1,039	106,810	3,039	103,964	2,983	62,076	2,177	65,645	2,295
Pike	11,400	684	5,840	351	7,892	463	11,664	690	15,850	954	14,370	865
Sea bass	1,320	40	1,260	38								
Shad	273.434	9,366	267,975	8,995	917,791	31,467	656,166	22,497	715,874	24,924	621,744	21,517
Sheepshead	1,150	130	1,020	115								
Spots and croakers	67.450	2,729	67.830	2,760	32,875	1,305	23,600	944	19.900	955	27,188	1,355
Squeteague	114,500	4,232	111,560	4,037	39,055	1,902	29,940	1,440	14,160	638	14,350	642
Striped bass	58,210	3,053	60,900	3,193	123,550	7,571	110,966	6,637	94,964	7,092	86,500	6,413
Sturgeon	2,680	130	2,700	80	16,400	820	9,400	478	18,192	733	11,785	497
Suckers	6,900	242	5,000	202	43,130	1,179	49,550	1,364	45,600	1,094	43,560	1,053
Other fish	26,600	1,064	26,660	1,064	39,050	1,633	36,989	1,636	47,765	1,640	49.134	1,692
Oysters	27,227,564	1,755,730	29,660,974	2,099,352	4,695,355	301,855	4,571,000	326,492	3.140,795	201,908	2,769,830	198,706
Clams (quahogs)	38,400	2,880	21,520	1,614								
Crabs, hard	483,334	7,250	558,334	8,375	225,134	3,377	291,833	4,377	72,133	1,082	108,433	1,626
Crabs, soft	2,498,536	149,913	2,814,885	168,894	166,733	5,002	208,433	6,253	366.734	16,503	648,567	29,185
Terrapins	12,500	2,500	16,200	3,240	17,500	5,250	19,200	5,760	6,800	1,980	7,800	2,340
Turtle	2,300	127	2,470	136								
Total	43,966,238	1,975.909	49,651,128	2,342,419	7,515,465	379,053	7,116,849	395,140	6,822,868	287,914	6,561,084	293,880

Statement by counties and species of the yield of the fisheries of Maryland—Continued.

Species.	Anne Arundel.				Baltimore.				Calvert.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives	571,800	$4,548	545,900	$4,485	375,350	$2,389	392,400	$2,550	460,000	$3,680	322,800	$2,820
Bluefish	51,200	2,560	72,500	3,425	9,920	496	10,100	505	50,400	2,466	64,200	2,924
Catfish	9,170	292	9,050	284	128,950	5,708	135,970	6 015	42,857	1,500	40,570	1,420
Eels	32,160	1,286	33,840	1,334	52,850	2,211	59,945	2,495				
Menhaden	25,000	90	23,606	86	9,210,000	17,687	7,576,000	17,783	766 500	1,755	727,500	1,675
Perch, white	27,260	1,470	26,990	1,462	148,173	8,099	151,253	8,290	34,650	1,874	35,780	1,799
Perch, yellow	35,010	1,345	37,160	1,410	226,480	6,959	244 400	7,424	27,465	973	31,170	1,112
Pike	5,940	421	6,056	428	138,534	8,693	142,945	8,974				
Shad	116,025	5,967	122,500	6,344	78,106	3,311	80,164	3,406	48,517	1,855	57,463	2,096
Spanish mackerel									9,500	1,330	16,200	1,944
Spots and croakers	27,580	1,653	28,470	1,701	12,050	365	11,600	351	5,000	250	6,000	300
Squeteague	1,000	50	1,600	80	6,910	346	5,650	283	9,000	450	10,700	535
Striped bass	53,520	5,171	54,930	5,328	189,152	14,499	192,210	14,716	29,460	2,837	29,927	2,692
Suckers					5,200	130	6,000	150				
Other fish	32,285	972	32,400	982	39,660	1,042	40,640	1,070	27,175	810	30,610	920
Oysters	6,420,659	379,506	4,307,835	337,830	7,536,172	590,031	5,369,322	554,231	2,530,640	168,353	2,248,960	182,977
Crabs, hard	955,333	11,264	897,333	10,768	30,000	450	31,200	468	8,265	97	9,165	110
Crabs, soft	189,533	19,620	177,000	18,900	38,000	4,275	40,360	4,641	2,840	342	3,200	360
Shrimp					7,556	3,720	8,044	3,960				
Total	8,553,475	436,217	6,377,164	394,847	18,233,063	670,411	14,498,203	637,312	4,052,269	188,572	3,634,245	203,684

Species.	Caroline.				Cecil.				Charles.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives	498,680	$4,241	384,100	$3,289	5,104,750	$24,156	4,021,870	$20,115	1,692,413	$11,096	993,645	$10,025
Bluefish									1,125	75	1,280	76
Catfish	66,803	2,493	61,485	2,280	152,240	5,644	143,210	5,334	25,900	785	28,325	883
Eels	20,150	806	19,835	793	107,615	4,864	100,561	4,612	5,750	212	6,790	248
Perch, white	29,100	1,473	25,520	1,303	118,685	6,165	110,320	5,730	26,600	1,379	25,093	1,273
Perch, yellow	63,835	2,415	50,295	1,878	306,090	8,849	283,890	8,192	16,200	689	16,750	742
Pike	17,767	1,066	17,645	1,060	148,514	9,473	135,121	8,622				
Shad	520,136	17,818	419,302	14,419	1,194,753	37,863	1,042,209	33,098	686,379	19,382	625,440	15,920
Spots and croakers					700	35	540	27	1,500	75	1,475	73
Squeteague									2,355	150	2,360	148
Striped bass	34,669	2,381	37,133	2,546	77,480	5,423	65,650	4,635	126,792	8,997	112,666	7,829
Sturgeon									60,000	1,500	45,600	1,140
Suckers	18,780	538	24,100	695	60,560	1,603	52,080	1,339	4,750	155	2,760	100
Other fish	26,855	790	28,600	839	50,370	1,511	45,445	1,361	8,210	306	7,103	213
Oysters									485,520	28,410	381,626	27,849
Crabs, hard									86,500	675	96,800	726
Terrapins									600	334	630	357
Total	1,296,775	34,021	1,068,015	29,102	7,321,757	105,586	6,000,896	93,095	2,630,594	74,220	2,348,343	67,602

Species	Dorchester.				Harford.				Kent.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives	763,265	$3,922	712,220	$3,669	4,809,700	$19,904	4,039,500	$43,004	622,100	$4,042	676,525	$4,955
Bluefish	21,210	851	20,760	913					44,900	1,715	42,987	1,696
Catfish	100,738	3,339	99,696	3,361	105,616	3,756	94,744	3,479	179,792	5,859	163,095	5,434
Eels	65,700	2,931	62,740	2,510	97,500	3,953	99,270	4,018	40,830	1,324	39,350	1,172
Menhaden	173,600	626	4,898,320	10,443								
Perch, white	59,325	2,970	52,150	2,596	96,666	5,060	82,204	4,327	159,000	9,352	173,444	10,658
Perch, yellow	85,808	2,798	76,125	2,611	97,286	3,405	102,733	3,790	176,363	8,235	181,664	8,245
Pike	28,790	1,570	27,485	1,519	57,785	4,045	52,786	3,754	71,100	5,081	70,010	5,277
Shad	446,548	15,336	445,865	15,309	1,143,394	42,352	956,431	35,320	360,024	12,843	320,873	11,548
Spanish mackerel									10,095	1,320	8,387	1,120
Spots and croakers	36,300	1,798	33,800	1,672					7,400	360	6,500	317
Squeteague	20,548	754	18,335	687					3,280	164	3,110	155
Striped bass	58,125	4,322	57,485	4,265	73,379	6,505	61,577	5,473	65,275	4,869	54,775	4,170
Sturgeon	2,660	130	2,960	148								
Suckers	44,204	1,094	43,033	1,090	47,927	1,255	41,755	1,100	9,030	233	8,950	228
Other fish	51,690	1,423	50,831	1,478	35,445	1,064	33,884	1,024	30,905	1,160	30,330	1,081
Oysters	11,060,987	711,189	11,563,622	825,982					1,670,984	121,738	1,675,100	143,538
Crabs, hard	290,100	4,351	483,400	7,250					43,300	622	27,500	450
Crabs, soft	633,500	19,005	760,167	22,805								
Terrapins	18,300	5,490	17,400	5,220								
Total	13,961,398	783,899	19,426,394	913,528	6,564,698	121,299	5,564,884	105,289	3,494,378	178,917	3,482,600	200,044

Statement by counties and species of the yield of the fisheries of Maryland—Continued.

Species.	Prince George.				Queen Anne.				St. Mary.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives	320,146	$2,831	265,581	$2,515	245,610	$2,559	208,200	$2,148	1,105,000	$7,587	1,306,300	$9,766
Bluefish	....	....	....	....	27,330	1,340	25,445	1,242	106,675	5,255	136,542	5,953
Catfish	86,270	3,135	83,340	2,878	62,700	1,886	62,602	1,880	28,000	670	39,208	912
Eels	....	....	....	....	45,450	1,880	34,230	1,668	6,300	253	8,520	341
Menhaden	....	....	....	....	4,200,000	8,750	1,200,000	2,500	741,656	1,552	749,500	1,561
Perch, white	9,417	565	11,610	568	106,600	5,958	88,061	4,770	39,889	2,149	43,883	2,426
Perch, yellow	5,725	229	5,200	210	100,070	3,960	123,244	5,075	15,588	547	19,372	687
Pike	....	....	....	....	18,960	1,403	20,357	1,557	....	....	....	....
Shad	92,533	2,851	54,391	1,975	50,610	2,346	61,429	2,823	202,100	6,597	230,200	8,555
Sheepshead	....	....	....	....	....	....	....	....	2,280	296	2,165	281
Spanish mackerel	....	....	....	....	....	....	....	....	8,600	1,108	20,250	2,305
Spots and croakers	....	....	....	....	6,050	237	5,220	208	45,200	1,797	50,450	1,977
Squeteague	....	....	....	....	2,700	147	3,700	268	233,665	7,368	240,410	7,614
Striped bass	5,610	515	6,131	565	156,210	14,717	114,290	11,198	107,070	8,082	105,788	8,115
Suckers	....	....	....	....	866	13	1,330	20	....	....	....	....
Other fish	17,940	486	15,230	395	26,550	691	20,435	537	45,752	1,618	48,908	1,688
Oysters	....	....	....	....	2,859,150	165,168	2,571,625	204,374	4,189,598	265,826	3,689,511	301,465
Crabs, hard	....	....	....	....	90,500	1,280	169,000	2,070	63,500	675	68,900	715
Crabs, soft	....	....	....	....	9,834	590	18,500	1,110	150,400	13,440	157,760	14,108
Crawfish	6,250	562	7,350	695	....	....	....	....	....	....	....	....
Terrapins	....	....	....	....	29,401	4,408	26,590	3,986	....	....	....	....
Turtle	....	....	....	....	1,680	100	1,590	95	....	....	....	....
Total	543,891	11,174	448,833	9,801	8,040,271	217,433	4,755,848	247,529	7,091,273	324,820	6,917,667	368,469

Species.	Worcester.				District of Columbia.				Total for State.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives	442,800	$3,871	441,900	$3,802	474,400	$4,135	465,485	$4,435	19,766,994	$143,793	17,418,850	$131,245
Bluefish	23,000	690	20,000	600	....	....	....	....	460,160	21,166	516,364	22,761
Catfish	19,913	751	21,374	805	7,150	214	11,050	341	1,327,562	46,675	1,296,752	45,502
Eels	79,200	3,876	72,808	3,518	....	....	....	....	791,282	33,005	792,044	32,919
Menhaden	210,000	540	205,000	472	....	....	....	....	27,969,556	57,180	30,952,120	65,307
Mullet	85,000	2,575	85,640	2,650	....	....	....	....	101,300	2,901	101,540	2,974
Perch, white	110,831	3,959	109,595	3,959	5,135	275	4,250	241	1,150,296	58,898	1,109,273	57,038
Perch, yellow	7,820	216	7,680	216	3,425	140	3,120	131	1,369,551	46,981	1,385,352	48,040
Pike	54,025	1,983	58,985	2,164	....	....	....	....	576,557	35,836	563,264	35,261
Sea bass	122,000	4,860	112,110	4,506	....	....	....	....	123,320	4,900	113,370	4,544
Shad	51,800	2,371	49,521	2,383	229,462	6,260	213,200	5,370	7,127,486	242,909	6,224,873	211,575
Sheepshead	....	....	....	....	....	....	....	....	3,430	426	3,185	396
Spanish mackerel	....	....	....	....	....	....	....	....	28,195	3,758	44,837	5,369
Spots and croakers	10,500	425	10,610	434	....	....	....	....	272,505	11,986	273,283	12,119
Squeteague	240,000	8,450	308,750	10,013	....	....	....	....	687,173	24,651	750,465	25,902
Striped bass	205,112	9,050	108,375	9,510	7,350	675	5,390	485	1,365,928	105,759	1,264,693	97,770
Sturgeon	....	....	....	....	....	....	....	....	99,932	3,313	72,445	2,343
Suckers	5,720	143	5,520	138	1,000	35	1,600	54	293,667	7,714	285,238	7,533
Other fish	28,285	905	31,040	935	7,050	279	3,470	159	541,587	17,394	531,709	17,134
Oysters	1,333,185	165,032	806,001	93,070	....	....	....	....	73,150,609	4,854,746	69,615,406	5,295,866
Clams (quahogs)	110,400	5,520	126,240	6,612	....	....	....	....	148,800	8,400	147,760	8,226
Crabs, hard	40,000	600	35,000	525	....	....	....	....	2,388,099	31,723	2,776,898	37,460
Crabs, soft	....	....	....	....	....	....	....	....	4,056,110	228,690	4,828,872	266,256
Crawfish	....	....	....	....	....	....	....	....	6,250	562	7,350	695
Shrimp	....	....	....	....	....	....	....	....	7,556	3,720	8,044	3,960
Terrapins	2,600	1,890	1,960	1,430	....	....	....	....	87,701	21,852	89,780	22,333
Turtles	....	....	....	....	....	....	....	....	3,980	227	4,060	231
Total	3,082,191	217,707	2,618,109	147,802	734,972	12,013	707,565	11,216	143,905,576	6,019,165	141,177,827	6,460,759

The products taken by each apparatus.—In the vessel fisheries of Maryland the only products obtained are oysters and menhaden. The yield of these in each county in 1890 and 1891 is shown in the following table. The use of vessels in the oyster fishery is observed in 10 counties, and menhaden are thus taken in 4 counties. The results of the vessel fisheries in 1891 were 4,814,114 bushels of oysters, valued at $2,615,840, and 28,816,000 pounds of menhaden, worth $60,533.

The results of the shore and boat fisheries with reference to the apparatus used are given in great detail for each county in the second table. In 1891 this branch yielded $3,784,386, of which oysters represented $2,680,026. The most important apparatus used in the capture of fish proper were seines, which took 14,312,398 pounds, valued at $265,443; alewives, shad, and striped bass constitute the principal part of the catch. Seines are most prominent in Harford, Baltimore, Worcester, and Cecil counties. Gill nets rank next to seines in the value of the output, although in the quantity of products taken pound nets are second. The gill-net catch was 8,447,291 pounds, valued at $211,291; more than half this amount represented shad. This form of apparatus is especially important in Cecil, Harford, Kent, and Talbot counties. The pound-net catch in 1891 was 8,458,299, worth $153,471. The fish thus taken having the greatest value are alewives, shad, and striped bass. St. Mary and Cecil counties excel all others in the value of their pound-net fishery. Of other prominent kinds of apparatus, fyke nets are credited with a catch of 1,546,864 pounds, valued at $60,549; lines, 970,135 pounds, valued at $35,271; pots, 389,740 pounds, valued at $16,030; weirs, 416,891 pounds, valued at $11,952, and trammel nets, 123,996 pounds, valued at $5,797. Under the head of miscellaneous apparatus are included all products except fish, although some of these, crabs and terrapins, for instance, are taken with appliances that are also employed in the capture of fish.

Statement by counties and species of the yield of the vessel fisheries of Maryland.

Counties.	Menhaden.				Oysters.				Total value.	
	1890.		1891.		1890.		1891.		1890.	1891.
	Pounds.	Value.	Pounds.	Value.	Bushels.	Value.	Bushels.	Value.		
Anne Arundel					125,612	$63,356	118,605	$67,000	$63,356	$67,000
Baltimore	9,210,000	$17,687	7,576,000	$17,783	1,076,596	590,031	767,046	554,231	607,718	572,014
Calvert					61,060	36,348	63,270	40,465	36,348	40,465
Dorchester			4,740,000	9,875	1,084,291	488,057	1,141,246	570,732	488,057	580,607
Kent					10,737	7,281	2,800	2,150	7,281	2,150
Queen Anne	4,200,000	8,750	1,200,000	2,500					8,750	2,500
Somerset	12,347,600	25,724	15,300,000	30,375	2,252,091	1,018,824	2,463,227	1,247,804	1,044,548	1,278,179
St. Mary					27,250	13,210	34,770	20,400	13,210	20,400
Talbot					145,465	65,470	142,500	71,242	65,470	71,242
Wicomico					86,285	38,828	75,590	38,656	38,828	38,656
Worcester					5,400	2,950	5,060	3,160	2,950	3,160
Total	25,757,600	52,161	28,816,000	60,533	4,874,787	2,324,355	4,814,114	2,615,840	2,376,516	2,676,373

Statement by counties, apparatus, and species of the yield of the shore fisheries of Maryland.

Apparatus and species.	Anne Arundel.				Baltimore.				Calvert.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Alewives	45,000	$340	58.000	$385	243,600	$1,580	258,350	$1,722	156.000	$1,300	141,200	$1,250
Bluefish	10,000	500	14,500	725	9,200	460	9,500	475	....	....	....	....
Catfish	1,250	42	1,500	50	33,550	3,722	87,100	3,884	....	....	....	....
Eels	....	....	....	....	12,630	505	13,000	520	....	....	....	....
Menhaden	....	....	....	....	....	....	....	....	364,000	950	340,000	900
Perch, white	9,500	570	9,850	591	98,375	5,400	101,500	5,579	19,500	1,090	19,060	1,005
Perch, yellow	16,000	640	17,000	680	113,925	3,879	117,300	3,972	13,140	460	14,710	515
Pike	3,585	256	3,720	265	82,648	5,320	86,010	5,543	....	....	....	....
Shad	12,775	657	14,700	800	63,000	2,700	65.338	2,800	11,900	610	14,700	630
Spots and croakers	9,000	540	9,300	580	12,050	365	11,600	351	....	....	....	....
Squeteague	1,000	50	1,600	80	6,910	346	5,650	283	....	....	....	....
Striped bass	32,160	3,216	34,630	3,463	174,407	13.270	177,370	13,486	4,280	430	4,867	485
Suckers	....	....	....	....	5,200	130	6,000	150	....	....	....	....
Other fish	6,735	202	7,500	225	26,800	670	29,000	726	8,210	240	11,660	350
Total	147.005	7,013	172,800	7,844	932,295	38,347	967,718	39,491	577,030	5.080	546,197	5,135
Pound nets:												
Alewives	480.000	3,820	440,000	3,700	91,750	529	92,250	538	280,000	2,000	144,000	1,080
Bluefish	22,000	1.100	36.000	1,600	720	36	600	30	5,400	216	7,200	324
Catfish	1,125	45	1,060	40	5,100	162	5,670	180	....	....	....	....
Eels	....	....	....	....	3,875	155	4,100	164	....	....	....	....
Menhaden	25.000	90	23,600	86	....	....	....	....	287,500	575	270,000	540
Perch, white	13,600	695	13.420	686	2,966	178	2,800	168	3,550	219	7,200	324
Perch, yellow	3,880	155	3,985	159	14,260	403	16,310	442	2,325	93	5,300	212
Pike	....	....	....	....	5,409	332	6,440	389	....	....	....	....
Shad	103,250	5,310	107,800	5,544	2,604	111	2,261	98	32.060	1,090	37,800	1,296
Span'h mack'l	....	....	....	....	....	....	....	....	9,500	1,330	16,200	1,944
Spots and croakers	18,580	1,115	18,670	1,121	....	....	....	....	5,000	250	6,000	300
Squeteague	....	....	....	....	....	....	....	....	9,000	450	10,700	535
Striped bass	12,000	1,080	11 500	1.035	6,625	585	6,640	582	14.680	1,462	10,900	1,082
Other fish	13,660	410	13,700	414	1,960	47	1,050	25	9,130	275	8.600	260
Total	693,095	13,820	669,735	14,385	135,269	2,538	138.121	2,616	658,145	7,960	523,900	7,897
Gill nets:												
Alewives	34,800	340	35,400	350	40,000	280	41,800	290	24,000	380	37,600	490
Bluefish	19,200	960	22,000	1,100	....	....	....	....	45,000	2,250	57,000	2,600
Catfish	2,860	85	2,620	78	....	....	....	....	....	....	....	....
Menhaden	....	....	....	....	....	....	....	....	115,000	230	117.500	235
Perch, white	4,160	205	3,720	185	3,056	163	4,210	229	11,600	565	9,520	470
Perch, yellow	12,300	465	12,850	471	8,320	273	8,980	291	12,000	420	11,160	385
Pike	2,145	150	2,050	143	15,227	925	15,750	958	....	....	....	....
Shad	....	....	....	....	12,502	500	12,565	508	4,557	155	4,963	170
Striped bass	5,860	525	5,000	450	3,750	300	3,860	308	10,500	945	14,160	1,125
Other fish	8,630	265	8,300	259	900	25	740	20	9,835	295	10,350	310
Total	89,955	2,995	91,940	3,036	83,755	2,466	87,905	2,604	232,492	5,240	262,253	5,785
Fyke nets:												
Alewives	12,000	48	12,500	50	....	....	....	....	....	....	....	....
Catfish	3,935	120	3,870	116	33,400	1,560	35,860	1,669	....	....	....	....
Eels	....	....	....	....	7,200	380	9,040	452	....	....	....	....
Perch, white	....	....	....	....	38,956	2,117	37.243	2,039	....	....	....	....
Perch, yellow	2,830	85	3,325	100	47,125	1,329	58,350	1,627	....	....	....	....
Pike	210	15	286	20	28,650	1,706	27,875	1,657	....	....	....	....
Striped bass	3,500	350	3.800	380	1,440	124	1,520	128	....	....	....	....
Other fish	3,260	95	2,900	84	8,760	269	8,500	265	....	....	....	....
Total	25,735	713	26,681	750	165,531	7,485	178,388	7,837	....	....	....	....
Weirs:												
Catfish	....	....	....	....	5,300	200	5,620	212	....	....	....	....
Perch, white	....	....	....	....	4,820	241	5,500	275	....	....	....	....
Perch, yellow	....	....	....	....	42,600	1,065	43,100	1,078	....	....	....	....
Pike	....	....	....	....	6,600	410	6,870	427	....	....	....	....
Striped bass	....	....	....	....	2,930	220	2,820	212	....	....	....	....
Other fish	....	....	....	....	1,240	31	1,350	34	....	....	....	....
Total	....	....	....	....	63,490	2,167	65,260	2,238	....	....	....	....
Lines:												
Catfish	....	....	....	....	1,600	64	1,720	70	42,857	1,500	40,570	1,420
Eels	....	....	....	....	520	26	680	34	....	....	....	....
Perch, yellow	....	....	....	....	250	10	360	14	....	....	....	....
Total	....	....	....	....	2,370	100	2,760	118	42,857	1,500	40,570	1,420
Pots:												
Eels	32,160	1,286	33,840	1,334	28,625	1,145	33,125	1,325	....	....	....	....
Miscellaneous:												
Oysters	5,541,375	316,150	3,477,600	270,830	....	....	....	....	2,103,220	132,005	1,806,070	142.512
Crabs, hard	955.333	11,264	897,333	10,768	30,000	450	31,200	468	8,265	97	9.165	110
Crabs, soft	189,533	19,620	177,000	18,900	38,000	4,275	40,360	4,641	2.840	342	3,200	360
Shrimp	....	....	....	....	7,556	3.720	8 044	3,960	....	....	....	....
Total	6,686,241	347,034	4,551,933	300,498	75,556	8,445	79.604	9,069	2,114,325	132,444	1,818,435	142,982
Grand total	7,674,191	372,861	5,546,929	327,847	1,486,891	62.693	1,552,881	65 298	3,624,849	152,224	3,191,355	163,219

Statement by counties, apparatus, and species of the yield of the shore fisheries of Maryland—Continued.

Apparatus and species.	Caroline.				Cecil.				Charles.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Alewives	240,600	$1,805	185,200	$1,389	2,780,500	$13,902	2,650,500	$13,252	416,600	$3,125	395,000	$3,060
Bluefish									1,125	75	1,280	76
Catfish	17,500	613	16,430	575	7,770	350	6,880	310	9,200	305	9,900	306
Eels	9,400	376	9,010	360	885	40	711	32				
Perch, white	11,500	595	6,300	325	3,500	175	3,200	160	1,000	55	1,250	58
Perch, yellow	21,600	875	18,500	740	68,400	1,710	67,200	1,680	3,600	165	3,850	179
Pike	10,200	612	10,920	654	10,571	740	10,060	705				
Shad	170,975	5,845	105,088	3,643	306,628	9,637	284,200	8,922	70,000	2,200	57,084	1,712
Spots and croakers					700	35	540	27	1,500	75	1,475	73
Squeteague									2,355	150	2,360	148
Striped bass	10,214	715	9,600	672	11,175	894	9,560	675	2,988	245	3,190	255
Suckers	9,900	297	13,900	417	3,600	90	3,280	82				
Other fish	9,165	275	8,560	255	5,330	160	4,000	120	900	30	1,100	35
Total	511,054	12,008	383,508	9,030	3,199,059	27,733	3,040,131	25,965	509,268	6,425	476,489	5,902
Pound nets:												
Alewives	135,800	1,079	105,200	850	1,306,000	5,030	780,500	3,800	600,813	7,071	531,845	6,260
Catfish	23,125	925	19,845	795	50,570	1,770	39,285	1,375	16,700	480	18,425	577
Eels					41,250	1,650	33,250	1,330	5,750	212	6,790	248
Perch, white	6,300	315	8,800	440	52,700	2,635	44,800	2,240	17,900	915	17,260	864
Perch, yellow	24,285	860	15,145	530	159,830	4,795	131,865	3,955	12,600	524	12,900	563
Pike	1,567	94	1,765	106	74,165	4,450	62,000	3,720				
Shad	66,325	2,274	53,638	1,839	131,509	4,509	111,475	3,822	111,956	3,126	114,416	2,860
Striped bass	5,850	410	6,070	425	41,930	2,935	33,200	2,410	95,820	6,395	88,580	5,810
Suckers	3,000	75	3,280	82	42,800	1,110	36,800	920	4,750	155	2,760	100
Other fish	5,020	150	6,000	180	16,330	490	13,560	405	2,350	118	2,550	90
Total	271,272	6,182	219,743	5,247	1,917,084	29,374	1,286,735	23,977	868,639	18,996	795,526	17,372
Gill nets:												
Alewives	98,600	1,090	70,500	775	945,700	4,728	521,000	2,604	75,000	900	66,800	705
Catfish					7,100	284	5,750	230				
Perch, white					12,200	620	11,400	570	7,700	409	6,583	351
Perch, yellow					7,300	219	7,500	225				
Pike					24,613	1,725	20,150	1,410				
Shad	276,325	9,474	253,838	8,705	743,400	23,264	634,298	19,935	501,123	14,056	453,940	11,348
Striped bass	8,930	625	11,740	822	17,800	1,068	14,050	843	27,984	2,357	20,896	1,764
Sturgeon									60,000	1,500	45,600	1,140
Suckers					4,360	109	4,600	115				
Other fish	7,500	225	8,660	260	6,860	206	6,435	193	4,960	158	3,453	88
Total	391,355	11,414	344,738	10,562	1,769,363	32,223	1,225,183	26,125	680,067	19,380	597,272	15,396
Fyke nets:												
Alewives	10,800	94	9,200	88	51,300	356	45,800	329				
Catfish	7,750	310	5,500	220	57,875	2,315	61,125	2,445				
Eels	6,750	270	6,625	265	65,480	3,174	66,600	3,280				
Perch, white	2,800	140	1,500	90	35,910	1,975	35,100	1,925				
Perch, yellow	6,250	270	4,750	190	44,665	1,340	49,335	1,480				
Pike	4,300	258	3,200	192	20,970	1,468	21,228	1,486				
Shad	1,530	55	1,313	47	3,066	105	4,361	149				
Striped bass	5,075	355	4,643	325	3,125	250	3,525	282				
Suckers	3,800	114	4,600	138	9,800	294	7,400	222				
Other fish	2,020	60	1,760	52	12,335	370	10,350	310				
Total	51,075	1,926	43,091	1,607	304,526	11,647	304,824	11,908				
Trammel nets:												
Catfish					5,650	225	6,750	270				
Perch, white					6,300	315	7,700	385				
Perch, yellow					12,335	370	13,667	410				
Pike					15,165	910	18,583	1,115				
Striped bass					2,700	216	4,375	350				
Other fish					6,165	185	7,500	225				
Total					48,315	2,221	58,575	2,755				
Weirs:												
Alewives	12,880	173	14,000	187	10,000	50	15,000	62				
Catfish	7,857	275	8,570	300	7,100	215	7,430	225				
Eels	4,000	160	4,200	168								
Perch, white	7,300	363	7,560	380	5,000	250	5,100	255				
Perch, yellow	11,700	410	11,900	418	12,500	375	13,000	390				
Pike	1,700	102	1,760	108	3,000	180	3,100	186				
Shad	4,981	170	5,425	185	10,150	348	7,875	270				
Striped bass	4,600	276	5,080	302								
Suckers	2,080	52	2,320	58								
Other fish	3,150	80	3,620	92	3,350	100	3,600	108				
Total	60,248	2,061	64,435	2,198	51,100	1,518	55,105	1,496				

Statement by counties, apparatus, and species of the yield of the shore fisheries of Maryland—**Continued.**

Apparatus and species.	Caroline.				Cecil.				Charles.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Lines:												
Catfish	10,571	$370	11,140	$390	16,175	$485	15,990	$479				
Perch, white	1,200	60	1,360	68	1,700	85	1,450	70				
Striped bass					750	60	940	75				
Total	11,771	430	12,500	458	18,625	630	18,380	624				
Minor apparatus:												
Alewives					11,250	90	9,070	68				
Perch, white					1,375	110	1,570	125				
Perch, yellow					1,060	40	1,323	52				
Total					13,685	240	11,963	245				
Miscellaneous:												
Oysters									485,520	$28,410	381,626	$27,849
Crabs, hard									86,500	675	96,800	726
Terrapins									600	334	630	357
Total									572,620	29,419	479,056	28,932
Grand total	1,296,775	34,021	1,068,015	29,102	7,321,757	105,586	6,000,896	93,095	2,630,594	74,220	2,348,343	67,602

Apparatus and species.	Dorchester.				Harford.				Kent.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Alewives	210,800	$1,054	185,400	$927	4,270,500	$46,928	3,562,000	$40,397	36,500	$223	68,500	$393
Bluefish	9,100	364	8,500	425					26,500	795	22,667	680
Catfish	15,290	535	12,575	440	11,625	465	8,550	342	64,460	2,012	58,730	1,816
Eels					10,550	475	9,335	420	2,000	100	1,500	75
Menhaden	26,800	120	23,400	102								
Perch, white	13,700	685	10,100	505	53,800	2,690	41,500	2,075	35,400	2,002	35,200	2,100
Perch, yellow	24,143	845	18,290	640	71,000	2,485	77,733	2,915	31,428	1,100	28,714	1,005
Pike	7,875	315	6,720	269	15,143	1,060	11,730	880	11,200	896	11,400	912
Shad	83,563	2,865	71,225	2,442	551,250	22,050	442,400	17,696	13,825	504	11,816	445
Spanish mackerel									5,428	760	4,267	640
Spots and croakers	11,500	558	11,300	547					4,000	200	4,200	210
Squeteague	8,648	279	7,280	245								
Striped bass	9,860	690	8,930	625	21,590	1,835	15,588	1,325	17,700	1,481	16,500	1,485
Sturgeon	960	45	1,040	52								
Suckers	10,200	204	11,500	230	9,860	250	7,600	190	4,200	105	5,700	142
Other fish	11,835	355	10,935	328	9,667	290	7,015	228	6,500	215	5,150	176
Total	444,274	8,914	387,195	7,777	5,024,985	78,528	4,183,451	66,468	259,141	10,393	274,344	10,079
Pound nets:												
Alewives	170,400	852	160,500	802					349,100	2,072	402,100	2,970
Bluefish	11,300	452	10,900	436					2,000	100	3,000	150
Catfish	28,143	985	30,571	1,070					28,660	860	24,655	840
Eels									8,730	286	6,000	200
Menhaden	16,200	114	12,120	98								
Perch, white	18,600	930	17,500	875					24,800	1,200	28,400	1,615
Perch, yellow	30,035	95	28,285	990					32,530	1,290	28,500	1,185
Pike	3,665	20	4,265	256					5,100	255	4,600	276
Shad	74,900	2,568	79,450	2,724					20,209	733	17,066	615
Spots and croakers	14,000	700	12,400	620					950	38	750	30
Squeteague	10,650	425	9,875	395					3,280	164	3,110	155
Striped bass	8,400	630	9,160	687					15,625	1,250	8,875	730
Sturgeon	1,700	85	1,920	96								
Suckers	25,200	652	22,100	602								
Other fish	12,725	380	13,576	475					5,330	120	5,960	140
Total	425,918	9,888	412,622	10,126					496,314	8,368	533,016	8,906
Trammel nets:												
Catfish					21,104	740	19,565	685				
Perch, white					10,720	590	9,810	540				
Perch, yellow					5,000	175	5,429	190				
Pike					7,642	535	7,285	510				
Striped bass					10,722	965	7,666	690				
Suckers					11,200	280	8,600	215				
Other fish					8,333	250	7,066	212				
Total					74,721	3,535	65,421	3,042				

Statement by counties, apparatus, and species of the yield of the shore fisheries of Maryland—Continued.

Apparatus and species.	Dorchester.				Harford.				Kent.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Gill nets:												
Alewives	320,800	$1,604	306,100	$1,529	425,200	$2,126	389,500	$1,947	144,400	$892	126,100	$825
Bluefish									16.400	820	17,320	866
Catfish					1,144	40	915	32	3,500	105	4,100	123
Menhaden	130,600	392	122,800	368								
Perch, white	16,800	840	14,620	721	14,180	780	13,450	740	69,500	4,350	79,544	5,068
Perch, yellow	13,500	468	13,200	458	3,715	130	2,857	100	46,000	2,300	52,500	2,375
Pike	10,950	657	9,820	590	23,428	1,640	22,485	1,574	33,000	2,235	30,450	2,260
Shad	281,750	9,660	289,275	9,918	592,144	20,302	514.031	17,624	318,115	11,273	285,950	10,243
Spanish mackerel									4,667	560	4,120	480
Squeteague	1,250	50	1,180	47								
Striped bass	23,100	1,848	22,000	1,760	36,445	3,280	33,778	3,040	25,450	1,608	22,900	1.445
Suckers					8,400	210	7,600	190				
Other fish	19,930	493	18,420	460	6,665	200	5,833	175	6,125	245	6,500	260
Total	818.680	16,012	797,415	15,851	1,111,321	28,708	990,449	25,422	667,157	24,388	629,484	23,945
Fyke nets:												
Alewives	26,600	132	23,400	117					91,200	846	79,100	760
Catfish	8,540	270	7,430	260	53,514	1,873	48,000	1,800	49,265	1,478	40,260	1,208
Eels	35,200	1,710	29,700	1,188	38,250	1,530	35,735	1,430	1,500	55	1,100	35
Perch, white	2,800	140	1,800	90	15,636	860	14,909	820	25,500	1,530	27,000	1,650
Perch, yellow	9,300	325	6,430	225	17,571	615	16,714	585	62,000	3,445	66,650	3,568
Pike	4,800	288	5,400	324	11,572	810	11,286	790	21,600	1,683	23,300	1,814
Shad	3,500	135	3,220	120					7,875	333	6,041	245
Spots and croakers									2,450	122	1,550	77
Striped bass	3,285	230	3,995	280	3,722	335	3,560	320	3,000	180	3,500	210
Suckers	8,804	238	9,433	258	7,800	195	6,790	170	3,700	111	2,500	75
Other fish	4,500	135	5,020	150	7,060	210	9,135	274	10,350	485	10,150	413
Total	107,329	3,603	95,828	3,012	155,065	6,428	146,129	6,189	278,440	10,268	261,151	10,055
Weirs:												
Alewives	34,665	280	36,820	294					900	9	725	7
Catfish	26,800	784	25,310	760								
Eels	1,100	45	1,240	50								
Perch, white	6,600	330	7,150	355								
Perch, yellow	6,250	247	9,420	283					2,680	32	3,490	40
Pike	1,500	90	1,280	80					200	12	260	15
Shad	2,835	108	2.695	105								
Spots and croakers	3,200	160	3,000	150								
Striped bass	11,200	784	10,900	763								
Suckers									1,130	17	750	11
Other fish	2,700	60	2,880	65					600	15	720	18
Total	98,850	2,888	100,695	2,905					5,510	85	5,945	91
Lines:												
Bluefish	810	35	1,360	52								
Catfish	21,965	765	23,810	831	18,229	638	17,714	620	6,670	200	7,300	219
Perch, white	825	45	980	50	2,330	140	2,535	152	3,800	270	3,300	225
Perch, yellow	580	18	500	15					1,725	68	1,810	72
Spots and croakers	7,600	380	7,100	355								
Striped bass	2,280	140	2,500	150	900	90	985	98	3,500	350	3,000	300
Other fish					1,530	46	2,000	60	2,000	80	1,850	74
Total	34,060	1,383	36,250	1,453	22,989	914	23,234	930	17,695	968	17,260	890
Pots:												
Eels	29,400	1,176	31.800	1,272	48,700	1,948	54,200	2,168	28.600	883	30,750	862
Minor apparatus:												
Alewives					114,000	850	88,000	660				
Catfish									27,237	1,204	28,050	1,228
Suckers					10,667	320	11,165	335				
Other fish					2,250	68	2,835	75				
Total					126,917	1,238	102,000	1,070	27,237	1,204	28,050	1,228
Miscellaneous:												
Oysters	3,470,950	223,132	3,574,900	255,250					1,595,825	114,457	1,655,500	141,388
Crabs, hard	290,100	4,351	483,400	7,250					43,300	622	27,500	450
Crabs, soft	633,500	19,005	760,167	22,805								
Terrapins	18,300	5,490	17,400	5,220								
Total	4,412,850	251,978	4,835,867	290,525					1,639,125	115,079	1,683,000	141,838
Grand total	6,371,361	295,842	6,697,672	332,921	6,564,698	121,299	5,564,884	105,289	3,419,219	171,636	3,463,000	197,894

Statement by counties, apparatus, and species of the yield of the shore fisheries of Maryland—Continued.

Apparatus and species.	Prince George.				Queen Anne.				St. Mary.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Alewives	263,046	$2,234	205,981	$1,835	80,100	$831	61,800	$630	100,000	$750	80,000	$600
Bluefish					15,800	790	12,210	611	9,550	440	8,762	404
Catfish	32,700	1,260	28,540	960	31,600	944	29,572	873	5,500	125	9,600	208
Eels					1,400	70	2,200	110	100	5	520	21
Menhaden									330,000	880	300,000	800
Perch, white	6,500	390	6,800	400	59,000	3,392	41,661	2,356	20,200	1,090	19,830	1,041
Perch, yellow	5,725	229	5,200	210	60,550	2,800	81,744	3,817	5,865	207	4,615	169
Pike					11,650	1,071	14,492	1,039				
Shad	85,421	2,656	44,786	1,720	15,575	712	21,091	964	9,100	390	10,150	435
Spots and croakers					4,300	172	3,670	147	8,500	420	8,070	417
Squeteague					2,200	132	3,100	250	14,250	665	14,080	608
Striped bass	1,280	125	1,520	150	107,500	10,095	71,240	7,120	12,020	1,050	11,650	1,006
Other fish	15,040	401	12,200	305	20,250	491	14,340	329	6,150	183	4,740	144
Total	409,712	7,295	305,027	5,580	412,925	21,500	357,120	18,246	521,235	6,205	472,017	5,853
Pound nets:												
Alewives	46,000	510	50,000	600	132,500	1,375	115,000	1,200	943,000	6,257	1,165,500	8,606
Bluefish					1,330	40	1,535	46	9,500	455	10,780	499
Catfish					1,400	28	1,600	32	22,500	545	29,608	704
Eels					6,800	300	7,530	350				
Menhaden									411,656	672	449,500	761
Perch, white					17,500	970	17,000	900	6,889	419	11,943	780
Perch, yellow					6,000	120	4,000	80	6,583	230	11,100	390
Shad	5,950	155	8,000	200	5,250	240	4,375	200	193,000	6,207	220,050	8,120
Spanish mackerel									6,200	868	14,000	1,680
Spots and croakers					1,750	65	1,550	61	8,500	402	11,240	536
Squeteague					500	15	600	18	36,189	1,810	37,250	1,701
Striped bass					10,100	900	5,560	500	33,200	2,600	30,798	2,355
Other fish	500	25	800	35	2,800	70	2,120	53	31,335	1,190	33,558	1,269
Total	52,450	690	58,800	835	185,930	4,123	160,870	3,440	1,708,552	21,655	2,025,327	27,401
Gill nets:												
Alewives	11,100	87	9,600	80	26,500	290	24,500	250	62,000	580	60,800	560
Bluefish					10,200	510	11,700	585	55,000	2,750	88,000	3,600
Catfish					1,700	44	1,730	46				
Perch, white	2,917	175	4,810	168	7,600	456	4,000	240	12,800	640	12,110	605
Perch, yellow					4,000	160	4,300	165	3,140	110	3,657	128
Pike					1,310	118	1,360	123				
Shad	1,162	40	1,605	55	29,785	1,394	35,963	1,659				
Spanish mackerel									2,400	240	6,250	625
Spots and croakers									2,100	105	2,640	132
Squeteague									3,600	180	6,030	295
Striped bass	4,330	390	4,611	415	20,950	2,092	17,100	1,708	14,000	1,280	18,140	1,690
Other fish	2,400	60	2,230	55					2,167	65	3,210	95
Total	21,909	752	22,856	773	102,045	5,064	100,653	4,776	157,207	5,950	200,837	7,730
Fyke nets:												
Alewives					4,910	48	5,600	55				
Catfish					26,000	810	27,200	854				
Perch, white					19,500	960	22,900	1,144				
Perch, yellow					24,200	825	26,600	943				
Pike					2,600	190	4,005	365				
Striped bass					13,660	1,230	16,890	1,520				
Other fish					2,000	80	2,550	110				
Total					92,870	4,143	105,745	4,991				
Weirs:												
Alewives					1,600	15	1,300	13				
Perch, yellow					5,320	55	6,600	70				
Pike					400	24	500	30				
Suckers					866	13	1,330	20				
Other fish					500	10	600	12				
Total					8,686	117	10,330	145				
Lines:												
Bluefish									32,625	1,610	29,000	1,450
Catfish	53,570	1,875	54,800	1,918	2,000	60	2,500	75				
Perch, white					3,000	180	2,500	130				
Sheepshead									2,280	296	2,165	281
Spots and croakers									26,100	870	28,500	892
Squeteague									179,626	4,713	183,050	5,010
Striped bass					4,000	400	3,500	350	47,850	3,152	45,200	3,064
Other fish					1,000	40	825	33	6,100	180	7,400	180
Total	53,570	1,875	54,800	1,918	10,000	680	9,325	588	294,581	10,821	295,315	10,877

Statement by counties, apparatus, and species of the yield of the shore fisheries of Maryland—Continued.

Apparatus and species.	Prince George.				Queen Anne.				St. Mary.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Pots:												
Eels					37,250	$1,510	24,500	$1,208	6,200	$248	8,000	$320
Miscellaneous:												
Oysters					2,859,150	165,168	2,571,625	204,374	3,998,848	252,616	3,446,121	281,065
Crabs, hard					90,500	1,280	169,000	2,070	63,500	675	68,900	715
Crabs, soft					9,834	590	18,500	1,110	150,400	13,440	157,760	14,108
Crawfish	6,250	$562	7,350	$695								
Terrapins					29,401	4,408	26,590	3,986				
Turtles					1,680	100	1,590	95				
Total	6,250	562	7,350	695	2,990,565	171,546	2,787,305	211,635	4,212,748	266,731	3,672,781	295,888
Grand total	543,891	11,174	448,833	9,801	3,840,271	208,683	3,555,848	245,029	6,900,523	311,610	6,674,277	348,069

Apparatus and species.	Somerset.				Talbot.				Wicomico.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value
Seines:												
Alewives	51,400	$257	41,500	$207	135,600	$687	120,500	$602	945,600	$4,715	840,500	$4,185
Bluefish	1,300	52	2,500	100	18,900	945	20,200	1,010	5,300	265	10,400	520
Catfish	8,200	410	9,500	475	35,500	1,065	52,000	1,560	28,680	1,005	24,960	875
Eels	1,050	31	900	27	2,860	114	3,000	120				
Menhaden	11,000	21	9,000	16								
Mullet	8,700	174	9,300	186								
Perch, white	4,600	184	3,400	136	21,300	852	20,700	828	13,600	680	10,500	525
Perch, yellow	5,200	156	4,160	175	31,200	936	35,200	1,056	22,100	775	20,570	720
Shad	24,325	834	28,525	978	24,934	855	27,384	939	184,013	6,325	165,746	5,682
Spots and croakers	700	30	620	25	9,900	386	11,600	464				
Squeteague	13,600	408	12,260	367	12,500	625	13,400	670	3,100	165	2,830	142
Striped bass	1,300	65	3,200	160	22,215	1,448	21,231	1,380	14,050	980	13,145	920
Sturgeon	1,300	65	900	35	9,400	470	3,200	168	3,060	95	1,800	62
Suckers					11,200	336	19,900	597	9,800	195	8,700	175
Other fish	2,800	140	3,500	175	20,500	615	17,634	529	8,850	310	9,060	317
Total	155,475	2,827	129,265	3,062	356,009	9,334	365,949	9,923	1,238,153	15,510	1,108,211	14,123
Pound nets:												
Alewives	80,500	402	51,300	256	130,080	1,230	144,244	1,342	285,700	1,428	305,100	1,533
Bluefish	2,600	104	1,200	48	24,600	1,230	18,500	925	27,500	1,375	19,500	975
Catfish	8,700	435	6,400	320	38,300	766	34,200	685	27,800	975	24,886	870
Eels					9,100	188	8,200	168	20,270	726	26,120	1,054
Menhaden	180,000	195	165,000	175	13,200	60	12,500	52				
Mullet	6,500	130	5,800	116								
Perch, white	9,300	372	7,300	292	19,500	682	17,200	602	21,300	1,065	25,600	1,280
Perch, yellow	7,400	222	10,100	303	22,800	513	19,500	439	23,940	840	30,285	1,060
Pike	7,300	438	1,700	102	5,800	348	9,700	582	11,200	672	10,500	630
Shad	34,216	1,173	41,700	1,251	36,491	1,251	20,741	711	118,370	4,059	108,763	3,729
Spots and croakers	10,100	467	9,800	448	17,700	708	7,700	308	13,900	655	20,260	1,010
Squeteague	9,800	490	6,500	325	21,200	1,060	10,500	525	3,060	153	2,800	140
Striped bass	2,700	135	1,700	85	16,400	984	17,500	1,050	10,900	872	10,475	838
Sturgeon	1,380	65	1,800	45	7,000	350	6,200	310	9,715	340	5,285	185
Suckers	3,500	140	2,600	130	22,400	563	19,900	491	28,200	705	25,920	648
Other fish	6,500	325	4,800	240	8,900	267	8,700	231	9,500	328	12,140	425
Total	370,496	5,093	317,700	4,136	393,471	10,200	355,285	8,421	611,355	14,193	627,634	14,377
Gill nets:												
Alewives	220,400	1,102	213,800	1,069	416,600	2,082	342,000	1,690	468,900	2,044	450,900	1,954
Bluefish	9,100	364	8,900	336	15,600	780	14,100	695				
Menhaden	6,000	10	7,100	12	85,000	170	78,600	157				
Perch, white	3,100	124	2,860	114	11,625	465	14,125	565	30,365	1,820	23,665	1,420
Perch, yellow	2,800	84	2,700	81	19,000	570	18,267	548				
Shad	211,043	7,236	193,634	6,634	846,216	29,013	600,600	20,592	387,188	13,380	326,025	11,109
Spots and croakers	2,050	63	1,800	55	3,275	131	2,550	102				
Squeteague	9,250	413	9,050	396	4,875	195	5,500	220				
Striped bass	36,900	1,845	38,900	1,945	62,600	3,756	52,000	2,945	29,850	2,388	21,200	1,696
Sturgeon									5,417	298	4,700	250
Other fish	6,800	288	7,140	315	1,600	48	1,870	56	17,145	600	14,100	490
Total	507,443	11,529	485,884	10,957	1,466,391	37,210	1,129,612	27,570	938,865	20,530	840,590	16,919

Statement by counties, apparatus and species of the yield of the shore fisheries of Maryland—Continued.

Apparatus and species.	Somerset.				Talbot.				Wicomico.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Fyke nets:												
Alewives	17,700	$88	17,400	$87	17,400	$87	14,300	$71	38,800	$192	32,900	$159
Catfish	3,800	190	3,470	173	15,600	390	14,400	360	64,250	2,570	66,110	2,650
Eels	26,500	1,060	21,500	860	12,500	450	10,200	408	32,400	1,296	38,700	1,548
Mullet	1,100	22	800	22								
Perch, white	1,600	64	1,300	52	10,125	405	9,580	383	5,600	280	4,800	240
Perch, yellow	5,700	171	4,800	144	6,330	190	6,182	185	11,286	395	9,610	335
Pike	2,900	174	2,800	168	2,092	115	1,964	108	4,200	252	3,500	210
Shad	2,275	78	2,541	87	10,150	348	7,441	255	4,813	165	3,570	120
Spots and croakers	1,400	64	1,560	70								
Squeteague	2,600	104	2,450	98								
Striped bass	2,700	135	3,200	160	19,800	1,188	17,500	1,050	37,714	2,640	39,500	2,765
Suckers	3,400	102	2,400	72	8,400	252	8,700	250	6,500	164	7,600	190
Other fish	2,700	81	2,400	72	2,500	75	2,065	62	6,080	210	7,684	270
Total	74,375	2,333	66,621	2,065	104,897	3,500	92,332	3,132	211,643	8,164	213,974	8,487
Weirs:												
Alewives	7,000	34	7,500	37	3,200	40	4,800	60	35,300	270	32,460	258
Catfish	5,200	181	4,950	167	4,500	225	2,300	115	12,800	348	9,257	224
Perch, white	1,400	56	1,220	49	2,300	115	1,700	85	5,600	280	6,000	300
Perch, yellow	3,600	108	3,260	98	4,380	130	3,515	105	4,030	145	4,580	160
Pike									450	30	370	25
Shad	1,575	45	1,575	45					3,815	140	3,360	115
Spots and croakers	600	25	500	20								
Squeteague	1,100	42	1,000	40								
Striped bass	7,060	420	6,800	408	1,250	100	1,550	125	500	45	380	34
Suckers					1,130	28	1,050	26	1,100	30	1,340	40
Other fish	1,000	25	1,280	35	950	28	1,300	40	960	32	1,000	35
Total	28,535	936	28,085	899	17,710	666	16,215	556	64,555	1,320	58,747	1,191
Lines:												
Bluefish	17,200	506	24,600	708	500	25	600	28	1,800	72	2,050	82
Catfish	9,300	327	10,100	354	1,400	35	1,520	38	80,560	3,260	73,550	2,925
Eels	610	15	860	21								
Perch, white	13,150	526	14,850	594					4,000	160	3,520	141
Perch, yellow	8,800	264	7,920	238								
Pike	1,200	72	1,340	81								
Sea bass	1,320	40	1,260	38								
Sheepshead	1,150	130	1,020	115								
Spots and croakers	52,600	2,080	53,550	2,142	2,000	80	1,750	70	6,000	300	6,928	345
Squeteague	78,150	2,775	80,300	2,811	480	22	540	25	8,000	320	8,720	360
Striped bass	7,550	453	7,100	435	1,285	95	1,185	87	1,100	90	900	80
Other fish	6,800	205	7,540	227	750	25	820	28	4,800	145	4,500	135
Total	197,830	7,393	210,440	7,764	6,415	282	6,415	276	106,260	4,347	100,168	4,068
Pots:												
Eels	41,850	1,674	38,750	1,550	24,500	980	23,375	935	31,400	1,296	46,400	1,856
Minor apparatus:												
Alewives					12,800	82	9,720	67	14,000	92	13,500	90
Catfish					1,600	40	1,580	38				
Perch, white									500	20	800	30
Perch, yellow					23,100	700	21,300	650	720	22	600	20
Shad									17,675	855	14,280	762
Striped bass									850	77	900	80
Other fish					3,850	575	4,600	690	430	15	650	20
Total					41,350	1,397	37,200	1,445	34,175	1,081	30,730	1,002
Miscellaneous:												
Clams (quahogs)	38,400	2,880	21,520	1,614								
Oysters	11,462,927	736,906	12,418,385	851,548	3,677,100	236,385	3,573,500	255,250	2,536,800	163,086	2,240,700	160,050
Crabs, hard	483,334	7,250	558,334	8,375	225,134	3,377	291,833	4,377	72,133	1,082	108,433	1,626
Crabs, soft	2,498,536	149,913	2,814,885	168,894	166,733	5,002	208,433	6,253	366,734	16,503	648,567	29,185
Terrapins	12,500	2,500	16,200	3,240	17,500	5,250	19,200	5,760	6,800	1,980	7,800	2,340
Turtles	2,300	127	2,470	136								
Total	14,497,997	899,576	15,831,794	1,033,807	4,086,467	250,014	4,092,966	271,640	2,982,467	182,645	3,005,500	193,201
Grand total	15,854,001	931,361	17,108,539	1,064,240	6,497,210	313,583	6,119,349	323,898	6,218,873	249,086	6,031,954	255,224

Statement by counties, apparatus, and species of the yield of the shore fisheries of Maryland—Continued.

Apparatus and species.	Worcester.				District of Columbia.				Total.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Alewives	330,500	$3,252	324,600	$3,163	226,400	$1,700	177,200	$1,550	10,532,746	$84,683	9,356,231	$75,547
Bluefish									106,775	4,686	110,519	5,026
Catfish	11,670	350	12,420	370	3,350	100	5,000	150	367,845	13,303	373,257	13,194
Eels									40,875	1,716	40,176	1,685
Menhaden	90,000	240	80,000	160					821,800	2,211	752,400	1,978
Mullet	30,000	1,200	35,600	1,400					38,700	1,374	44,300	1,586
Perch, white	59,100	2,364	62,750	2,510	3,435	190	2,340	140	434,010	22,404	395,941	20,334
Perch, yellow	5,720	150	5,280	142	2,125	88	1,660	66	501,721	17,500	521,726	18,681
Pike	31,625	1,245	34,625	1,365					187,497	11,515	189,677	11,632
Sea bass	120,000	4,760	110,000	4,400					120,000	4,760	110,000	4,400
Shad	25,725	909	25,021	1,005	39,375	922	25,600	680	1,692,384	60,671	1,414,854	51,493
Spanish mackerel									5,428	760	4,267	640
Spots and croakers	5,000	150	5,200	156					67,150	2,931	68,075	2,997
Squeteague	115,000	4,600	135,000	5,400					179,563	7,420	197,560	8,193
Striped bass	74,600	6,980	80,500	7,525	5,850	540	3,280	295	523,189	44,059	486,001	41,027
Sturgeon									14,720	675	6,940	517
Suckers	5,000	125	4,520	113					68,960	1,732	81,100	2,096
Other fish	10,960	310	11,780	325	5,750	230	1,200	50	175,442	5,117	159,374	4,617
Total	914,900	26,635	926,696	28,034	286,285	3,770	216,280	2,931	15,878,805	287,517	14,312,398	265,443
Pound nets:												
Alewives					248,000	2,435	288,285	2,885	5,279,643	36,090	4,775,824	36,422
Bluefish									106,950	5,108	109,215	5,033
Catfish					3,800	114	6,050	191	255,923	8,090	242,255	7,679
Eels									95,775	3,517	91,990	3,514
Menhaden									933,556	1,706	932,720	1,712
Mullet									6,500	130	5,800	116
Perch, white					1,700	85	1,910	101	216,605	10,680	221,133	11,167
Perch, yellow					1,300	52	1,460	65	347,768	10,992	318,735	10,373
Pike									114,206	6,809	100,970	6,061
Shad					7,087	388	29,600	740	943,177	33,194	957,135	33,749
Spanish mackerel									15,700	2,198	30,260	3,624
Spots and croakers									90,480	4,400	88,370	4,434
Squeteague									93,679	4,567	81,335	3,794
Striped bass					1,500	135	2,110	190	275,730	20,373	243,068	17,779
Sturgeon									19,795	840	15,205	636
Suckers					1,000	35	1,600	54	130,850	3,435	114,960	3,027
Other fish					1,300	49	2,270	109	127,340	4,244	129,384	4,351
Total					265,687	3,293	333,285	4,335	9,053,677	156,373	8,458,299	153,471
Gill nets:												
Alewives	106,500	590	110,500	605					3,420,500	19,115	2,806,900	15,723
Bluefish									170,500	8,434	219,020	9,782
Catfish									16,304	558	15,115	509
Menhaden	120,000	300	125,000	312					456,600	1,102	451,000	1,084
Mullet	55,000	1,375	50,640	1,250					55,000	1,375	50,640	1,250
Perch, white	50,500	1,520	45,610	1,375					258,103	13,132	250,227	12,821
Perch, yellow									132,675	5,199	137,971	5,227
Pike	21,100	660	22,960	715					131,803	8,110	125,025	7,773
Shad	24,850	1,420	23,100	1,330	183,000	4,950	158,000	3,950	4,416,46[illegible]	146,117	3,787,787	123,780
Spanish mackerel									7,067	800	10,370	1,105
Spots and croakers	4,000	200	4,250	210					11,425	499	11,240	499
Squeteague	65,000	1,950	63,750	1,913					83,975	2,788	85,510	2,871
Striped bass	29,500	1,975	26,900	1,885					357,949	26,282	327,235	23,841
Sturgeon									65,417	1,798	50,300	1,390
Suckers									12,760	319	12,200	305
Other fish	8,060	240	9,510	295					109,577	3,413	106,751	3,331
Total	484,510	10,230	482,220	9,890	183,000	4,950	158,000	3,950	9,705,515	239,041	8,447,291	211,291
Trammel nets:												
Catfish									26,754	965	26,315	955
Perch, white									17,020	905	17,510	925
Perch, yellow									17,335	545	19,096	600
Pike									22,807	1,445	25,868	1,625
Striped bass									13,422	1,181	12,041	1,040
Suckers									11,200	280	8,600	215
Other fish									14,498	435	14,566	437
Total									123,036	5,756	123,996	5,797

Statement by counties, apparatus, and species of the yield of the shore fisheries of Maryland—Continued.

Apparatus and species.	Worcester.				District of Columbia.				Total.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds	Value.	Pounds.	Value.	Pounds.	Value.
Fyke nets:												
Alewives									270,710	$1,891	240,200	$1,716
Catfish									323,929	11,886	313,225	11,755
Eels	8,400	$336	7.200	$288					234,180	10,261	226,400	9,754
Mullet									1,100	22	800	22
Perch, white	1,000	60	900	54					159,427	8,531	157,032	8,487
Perch, yellow	1,580	45	1.800	50					238,837	9,035	254,546	9,432
Pike	1,300	78	1,400	84					105,194	7,037	106,244	7.218
Shad									33,209	1,219	28,487	1,023
Spots and croakers									3,850	186	3,110	147
Squeteague									2,600	104	2,450	98
Striped bass									97,021	7,017	101,633	7.420
Suckers									52,204	1,470	49,423	1,375
Other fish	600	30	800	40					62,105	2,100	63,314	2,102
Total	12,880	549	12,100	516					1,584,366	60,759	1,546,864	60.549
Weirs:												
Alewives	5,800	29	6,800	34					111,345	900	119,405	952
Catfish	743	26	854	30					70.300	2,254	64,291	2,033
Eels									5,100	205	5,440	218
Perch, white	231	15	335	20					33,251	1,650	34.565	1,719
Perch, yellow	520	21	600	24					95,580	2,588	99,465	2,666
Pike									13,850	848	14,140	871
Shad	1,225	42	1,400	48					24,581	853	22,330	768
Spots and croakers									3,800	185	3,500	170
Squeteague									1,100	42	1,000	40
Striped bass	330	30	285	28					27,870	1.875	27,815	1,872
Suckers	720	18	1.000	25					7,026	158	7,790	180
Other fish	665	20	800	24					15.115	401	17,150	463
Total	10,234	201	12,074	233					408,918	11,959	416,891	11,952
Lines:												
Bluefish	23,000	690	20,000	600					75,935	2,938	77,610	2,920
Catfish									264,897	9,579	260,714	9,339
Eels	800	40	608	30					1,930	81	2,148	85
Perch, white									30,005	1,466	30,495	1,430
Perch, yellow									11,355	360	10,590	339
Pike									1,200	72	1,340	81
Sea bass	2,000	100	2,110	106					3,320	140	3,370	144
Sheepshead									3,430	426	3,185	396
Spots and croakers	1,500	75	1,160	68					95.800	3,785	98,988	3,872
Squeteague	60,000	1,900	110.000	2,700					326,256	9,730	382,610	10,906
Striped bass	682	65	690	72					69,897	4,895	66 000	4,711
Other fish	8,000	305	8,150	311					30,980	1,026	33,085	1.048
Total	95.982	3,175	142,718	3,887					915,005	34,498	970,135	35,271
Pots:												
Eels	70.000	3,500	65,000	3,200					378,685	15,646	389.740	16,030
Minor apparatus:												
Alewives									152,050	1,114	120,290	885
Catfish	7,500	375	8.100	405					1.600	40	1,580	38
Eels									34,737	1,579	36,150	1,633
Perch, white									1.875	130	2,370	155
Perch, yellow									24.880	762	23,223	722
Shad									17,675	855	14,280	762
Striped bass									850	77	900	80
Suckers									10,667	320	11,165	335
Other fish									6.530	658	8,085	785
Total	7,500	375	8,100	405					250,864	5,535	218,043	5,395
Miscellaneous:												
Clams (quahogs)	110,400	5,520	126,240	6,612					148,800	8,400	147,760	8.226
Oysters	1,295,385	162,082	770,581	89,910					39,027,100	2,530,391	35,916,608	2,680,026
Crabs, hard	40,000	600	35,000	525					2,388,099	31,723	2,776,898	37,460
Crabs, soft									4,056,110	228,690	4,828.872	266,256
Crayfish									6,250	562	7,350	695
Shrimp									7,556	3,720	8,044	3,960
Terrapins	2,600	1,890	1,960	1,430					87.701	21,852	89,780	22.333
Turtles									3,980	227	4,060	231
Total	1,448.385	170,092	933,781	98.477					45,725,596	2,825,565	43,779,372	3,019,187
Grand total	3,044,391	214,757	2,582,689	144,642	734,972	$12.013	707,565	$11,216	84,024,467	3,642,649	78,663,029	3,784,386

FISHERIES OF VIRGINIA.

Importance and prominent features of the industry.—In the item of persons employed, Virginia ranks second among the Middle Atlantic States, while in the matter of invested capital and value of products it occupies the third position. Considering the entire country, the rank of Virginia as a fishing State, based on the value of the catch, is fifth.

Virginia shares with Maryland the excellent physical advantages which have contributed so materially to the development of the fishing industry. The natural resources of the waters are very similar to those possessed by Maryland. Fishing operations are extensively carried on in Chesapeake Bay, in the two large sounds forming a part thereof—Tangier and Pocomoke—in the Potomac, Wicomico, Rappahannock, York, and James rivers, which enter the western side of the Chesapeake, and in the ocean from those parts of the State above and below the entrance to the bay.

The oyster fishery of Virginia overshadows all other branches and is more prominent than in any other State except Maryland. Next in importance are the shad fishery, the menhaden fishery, the squeteague fishery, the alewife fishery, the bluefish fishery, and the Spanish-mackerel fishery. In the catch of Spanish mackerel, menhaden, pompano, spots, and croakers, Virginia surpasses all the other States of this region. The shad fishery is next in importance to that of Maryland. Virginia ranks next to Maryland in the number of vessels engaged in the fishing industry and in the extent of the oyster-packing trade; while its menhaden industry is more important than in any other State. The increase in the pound-net fishery in recent years constitutes one of the most prominent features of the industry, and no other coast State now has so many pound nets.

Condensed statistics.—A summarized statistical presentation of the fisheries of Virginia is contained in the three following tables, relating to the years 1890 and 1891.

Of the 23,595 persons engaged in the industry in the latter year, 3,603 were vessel fishermen, 16,027 were shore and boat fishermen, 705 were on vessels employed in transporting fishery products, and 3,260 were in the shore branches connected with the fisheries, such as oyster packing, the manufacture of menhaden oil and fertilizer, etc.

The money value of the fishing property in Virginia in 1891 was $2,948,659. The factors in this amount were 943 vessels valued, with their outfits, at $939,136; 9,247 boats, worth $463,722; apparatus to the value of $360,514; shore property and cash capital, $1,185,287.

Of the total value of the fisheries, $3,647,845 in 1891, $2,524,348 accrued from the sale of oysters; shad were worth $207,394; menhaden, $197,523; squeteague, $124,645; alewives, $93,905; bluefish, $67,545, and Spanish mackerel, $50,756.

Persons employed in the fisheries of Virginia.

How engaged.	1890.	1891.
In vessel fisheries	3,627	3,603
In shore fisheries	15,718	16,027
On transporting vessels	710	705
On shore, in factories, etc	2,714	3,260
Total	22,769	23,595

Vessels, boats, apparatus, shore property, and cash capital employed in the fisheries of Virginia.

Designation.	1890.		1891.	
	No.	Value.	No.	Value.
Vessels fishing	730	$503, 100	729	$498, 440
Tonnage	9, 110		9, 087	
Outfit		172, 549		169, 933
Vessels transporting	211	246, 705	214	241, 695
Tonnage	5, 124		5, 084	
Outfit		29, 280		29, 068
Boats	9, 153	457 038	9, 247	463, 722
Apparatus—vessel fisheries:				
Seines	42	26, 250	41	25, 650
Lines		10		30
Dredges	470	18, 480	460	18, 210
Tongs	1, 324	6, 323	1, 367	6, 482
Apparatus—shore fisheries:				
Seines	172	30, 615	178	32, 470
Gill nets	5, 702	45, 587	5, 979	46, 030
Apparatus—shore fisheries—Cont'd.				
Pound nets	862	$162, 295	891	$165, 990
Fyke nets	335	5, 585	339	5. 770
Weirs	50	1, 000	50	1, 000
Minor nets	889	442	888	442
Lines		3, 396		3, 432
Pots, eel	110	95	110	95
Spears	15	10	15	10
Tongs, rakes, and nippers	10, 694	49, 726	10, 756	50, 263
Dredges	182	3, 995	198	4, 640
Shore and accessory property		664, 095		717, 787
Cash capital		444, 800		467, 500
Total		2, 871, 376		2, 948, 659

Products of the fisheries of Virginia.

Species.	1890.		1891.	
	Pounds.	Value.	Pounds.	Value.
Alewives	10, 641, 698	$91, 674	11, 013, 485	$93, 905
Black bass	7, 500	450	7, 000	430
Bluefish	1, 471, 671	57, 195	1, 842, 264	67, 545
Butter-fish	138, 753	3, 442	120, 000	2, 900
Carp	8, 735	385	13, 370	576
Catfish	939, 902	27, 833	935, 244	28, 487
Cobia or crab-eater	194, 537	4, 798	195, 250	4, 948
Croakers	1, 124, 525	38, 645	1, 075, 690	36, 847
Drum	186, 950	4, 154	179, 502	4, 011
Eels	71, 930	3, 019	71, 619	2, 907
Flounders	126, 135	4, 209	127, 295	4, 109
Kingfish and whiting	168, 056	7, 920	149, 565	7, 097
Menhaden	107, 341, 713	209, 588	105, 980, 334	197, 523
Mullet	104, 500	2, 555	110, 700	2, 736
Perch, white	306, 521	12, 445	299, 813	12, 010
Perch, yellow	184, 493	7, 420	169, 020	6, 799
Pike	16, 558	1, 039	12, 415	795
Pompano	86, 246	8, 466	93, 700	9, 520
Sea bass	61, 323	2, 044	66, 310	2, 270
Shad	7, 266, 207	$228, 897	6, 498, 242	$207, 394
Sheepshead	22, 775	1, 266	23, 871	1, 344
Spanish mackerel	648, 793	47, 161	739, 910	50, 756
Spots	4, 651, 473	25, 426	650, 157	25, 275
Squeteague	072, 304	130, 740	3, 929. 899	124, 645
Striped bass	529, 159	47, 202	483, 436	42, 127
Sturgeon	817, 670	24, 514	723, 646	21, 364
Suckers	118, 067	3, 190	116, 364	3, 153
Other fish	1, 602, 636	41, 247	1, 514, 657	38, 675
Crabs, hard	2, 584, 794	28, 210	2, 208, 071	32, 683
Crabs, soft	440, 340	26. 054	585, 956	29, 379
Crawfish			833	75
Oysters	42, 518, 174	2, 482. 348	43, 134, 602	2, 524, 348
Quahogs or hard clams	551, 888	36. 815	559, 278	36, 030
Frogs	20, 232	2. 655	21, 000	2, 754
Terrapins	52, 519	19, 066	52, 215	18, 494
Turtles	203, 928	4, 279	189, 121	3, 934
Total	185, 282, 705	3, 636, 351	183, 993, 834	3, 647, 845

In the following supplementary table the quantities of certain products shown in the foregoing table are given on another basis than pounds:

Species.		1890.	1891.
Oysters	bushels	6. 074, 025	6, 162, 086
Clams	do	66. 486	69. 910
Crabs, hard	number	7, 754, 382	6, 924 213
Crabs, soft	do	1. 321, 020	1, 757, 868
Crawfish	do		11, 196
Frogs	do	40, 464	42, 000
Terrapins	do	26, 259	26, 103

Statistics of the fisheries in each county.—Thirty-four counties in Virginia have commercial fisheries, and the extent of the industry in each of these is shown in the tables which follow.

Norfolk County, with its extensive oyster business, leads in the number of persons employed, having 3,653 in 1891, of which 1,821 were shoresmen. Accomac County ranks next, with 3,633, but surpasses Norfolk County in the number of vessel and

shore fishermen. Lancaster and Middlesex counties have between 2,000 and 3,000 persons, and Elizabeth City, Gloucester, Mathews, and Northumberland counties are credited with over 1,000 persons each.

Norfolk County also has the largest capital invested in the fishing industry. In 1891 this amounted to $707,881, of which, however, $518,250 represented shore property and cash capital. Accomac County, with an investment of $493,553, has much the largest amount devoted to actual fishing. In the items of vessels and seines this county also has the first place. Northumberland County has the largest number of pound nets, James City of gill nets, and York of fyke nets.

The value of the fisheries of Accomac County is about twice that of any other county in Virginia, except Lancaster. In 1891 it was $731,613, of which $568,410 represented the sale of oysters and $43,055 menhaden, the next important product. Lancaster County fishermen took fish and oysters to the value of $496,010, of which $351,370 accrued from the oyster fishery and $79,893 from the menhaden fishery. The fisheries of Norfolk County yielded $245,807, of which $228,400 was the value of the oyster output. Elizabeth City County exceeded Norfolk in the aggregate value of the fisheries, having $306,495 to its credit, although the oyster yield was only $168,988. The value of the products taken in the fisheries of Northumberland County was $250,116, oysters constituting $120,160. In Middlesex County, the fishing industry gave an income of $244,060, including $231,560 worth of oysters. The fisheries of Northampton County were worth $236,955, the value of the oysters being $167,756.

Statement by counties of the number of persons employed in the fisheries of Virginia.

Counties.	On fishing vessels.		On transporting vessels.		In shore fisheries.		On shore, in fish houses, etc.		Total.	
	1890.	1891.	1890.	1891.	1890.	1891.	1890.	1891.	1890.	1891.
Accomac	1,393	1,300	124	113	1,812	1,937	217	283	3,546	3,633
Alexandria			35	37	122	138			157	175
Caroline					22	32			22	32
Charles City					228	228			228	228
Chesterfield					75	75			75	75
Dinwiddie					25	25			25	25
Elizabeth City	130	143	12	16	539	539	298	303	979	1,001
Essex			8	5	369	399		25	377	429
Fairfax					206	217			206	217
Gloucester	121	129	71	68	872	872			1,064	1,069
Hanover					62	62			62	62
Henrico	8	8			40	40			48	48
Isle of Wight	69	67			378	378	16	16	463	461
James City					174	181			174	181
King and Queen			4	4	226	227			230	231
King George					154	154			154	154
King William	16	20	14	14	238	240	33	19	301	293
Lancaster	132	123	16	10	2,421	2,436	171	166	2,740	2,735
Mathews	65	49	110	109	949	930			1,124	1,088
Middlesex	14	14	38	37	1,861	1,885	185	197	2,098	2,133
Nansemond	132	140	16	16	370	370	105	105	623	631
New Kent			9	9	196	196			205	205
Norfolk	818	805	143	141	860	886	1,433	1,821	3,254	3,653
Northampton	89	120	33	44	490	523	19	33	631	720
Northumberland	275	299	37	43	994	989	183	183	1,489	1,514
Prince George					97	97			97	97
Princess Anne					221	221	45	45	266	266
Prince William					73	77			73	77
Richmond	15	15	10	13	476	481	16	56	517	565
Stafford					139	139			139	139
Surry					48	48			48	48
Warwick	46	49	3	3	170	170	8	8	227	230
Westmoreland	89	113	18	14	456	461			563	588
York	215	209	9	9	374	374			598	592
Total	3,627	3,603	710	705	15,737	16,027	2,729	3,260	22,803	23,595

Statement by counties of the vessels, boats, apparatus, shore property, and cash capital employed in the fisheries of Virginia.

Designation.	Accomac.				Alexandria.				Caroline.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	249	$233,370	235	$219,860								
Tonnage	3,496		3,292									
Outfit		55,451		50,775								
Vessels transporting	34	66,090	32	54,320	12	$11,200	13	$12,200				
Tonnage	1,187		1,061		179		193					
Outfit		3,803		3,705		1,750		1,850				
Boats	1,222	68,124	1,273	73,052	43	2,275	50	2,655	19	$195	21	$225
Apparatus—vessel fisheries:												
Seines	14	8,900	15	9,400								
Dredges	328	11,480	310	10,850								
Tongs	148	1,485	150	1,500								
Apparatus—shore fisheries:												
Seines	68	1,865	70	1,940	2	2,000	3	2,500	1	1,200	2	2,400
Pound nets	26	2,850	29	3,250	2	200	2	200	4	800	4	800
Gill nets	155	930	165	990	35	2,625	37	2,775	20	400	20	400
Fyke nets	4	80	3	60								
Miscellaneous nets	20	10	19	10								
Lines		203		201								
Spears	15	10	15	10								
Dredges	154	2,670	170	3,315								
Tongs, rakes, and nippers	1,399	6,720	1,470	7,313								
Shore property		37,170		40,002		275		225				
Cash capital		13,500		13,000								
Total		514,711		493,553		20,325		22,405		2,595		3,825

Designation.	Charles City.				Chesterfield.				Dinwiddie.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Boats	115	$1,544	115	$1,544	85	$1,275	85	$1,275	15	$225	15	$225
Apparatus—shore fisheries:												
Seines	6	1,855	6	1,855	3	1,050	3	1,050	4	600	4	600
Gill nets	135	4,660	135	4,660	625	1,875	625	1,875	15	375	15	375
Lines		40		40								
Shore property		1,600		1,600		500		500				
Total		9,699		9,699		4,700		4,700		1,200		1,200

Designation.	Elizabeth City.				Essex.				Fairfax.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	21	$11,375	24	$12,575								
Tonnage	288		323									
Outfit		7,927		8,488								
Vessels transporting	4	4,300	5	5,000	3	$750	2	$350				
Tonnage	84		111		37		15					
Outfit		290		360		193		106				
Boats	297	20,680	299	20,720	285	5,227	290	5,282	55	$5,775	59	$5,895
Apparatus—vessel fisheries:												
Seines	3	1,950	3	1,950								
Dredges	32	1,600	34	1,700								
Tongs	75	300	81	324								
Apparatus—shore fisheries:												
Seines	6	1,200	6	1,200	1	150	1	150	2	7,500	2	7,500
Pound nets	71	16,150	73	16,500	30	4,500	30	4,500	17	1,775	23	2,335
Gill nets					646	2,623	721	2,698	27	2,700	27	2,700
Fyke nets	4	200	4	200	15	225	18	270				
Lines		1,375		1,375		55		55				
Pots					10	20	10	20				
Tongs, rakes, and nippers	450	1,800	450	1,800	224	896	224	896				
Shore property		92,025		95,825		1,000		1,800		36,865		36,865
Cash capital		78,000		80,000				4,000				
Total		239,172		248,017		15,639		20,127		54,615		55,295

Statement by counties of the vessels, boats, apparatus, shore property, and cash capital employed in the fisheries of Virginia—Continued.

Designation.	Gloucester.				Hanover.				Henrico.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	38	$19,550	38	$23,740					1	$1,000	1	$1,000
Tonnage	392		437						15		15	
Outfit		5,544		6,029						357		357
Vessels transporting	19	30,100	19	29,200								
Tonnage	602		575									
Outfit		3,254		3,117								
Boats	527	30,055	527	30,055	31	$475	31	$475	30	300	30	300
Apparatus—vessel fisheries:												
Tongs	92	368	98	392					6	24	6	24
Apparatus—shore fisheries:												
Seines	29	665	29	665					1	300	1	300
Pound nets	96	18,900	96	18,900								
Gill nets	110	530	110	530	65	1,300	65	1,300	50	1,500	50	1,500
Fyke nets	38	475	38	475								
Weirs									50	1,000	50	1,000
Miscellaneous nets	40	20	40	20								
Lines		40		40								
Tongs, rakes, and nippers	616	2,358	616	2,358								
Shore property		6,725		6,725		700		900				
Total		118,584		122,246		2,475		2,675		4,481		4,481

Designation.	Isle of Wight.				James City.				King and Queen.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	21	$6,500	20	$6,400								
Tonnage	180		171									
Outfit		3,964		3,719								
Vessels transporting									1	$1,500	1	$1,500
Tonnage									43		43	
Outfit										135		135
Boats	197	8,995	197	8,995	90	$3,729	90	$3,729	107	2,635	107	2,635
Apparatus—vessel fisheries:												
Tongs	52	208	48	192								
Apparatus—shore fisheries:												
Seines	1	60	2	100	1	80	1	80	2	500	2	500
Gill nets	156	886	156	886	869	2,105	869	2,105	347	2,625	347	2,625
Fyke nets	28	420	28	420	66	675	66	675	18	225	18	225
Lines		375		375								
Pots	100	75	100	75								
Tongs, rakes, and nippers	202	808	202	808	84	336	84	336	80	320	80	320
Shore property		13,900		13,900		1,050		1,050		4,680		4,680
Total		36,191		35,870		7,975		7,975		12,620		12,620

Designation.	King George.				King William.				Lancaster.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing					5	$2,900	6	$3,500	11	$32,050	12	$29,600
Tonnage					40		49		351		319	
Outfit						1,039		1,248		11,329		7,889
Vessels transporting					4	2,400	4	3,800	5	4,000	3	2,200
Tonnage					54		75		153		103	
Outfit						571		598		836		470
Boats	79	$1,755	80	$1,805	119	1,905	119	1,905	1,422	88,700	1,422	89,055
Apparatus—vessel fisheries:												
Seines									13	7,900	11	6,800
Dredges									2	100	2	100
Tongs					12	48	13	52	6	24	11	70
Apparatus—shore fisheries:												
Seines	3	900	3	900								
Pound nets	66	8,970	68	9,195	1	240	1	240	93	12,900	93	12,900
Gill nets	80	1,600	80	1,600	245	4,900	245	4,900				
Miscellaneous nets										80		80
Lines						144		144				
Tongs, rakes, and nippers					12	48	12	48	1,683	7,512	1,683	7,512
Shore property						5,690		3,390		52,650		52,650
Cash capital						3,800		5,800		78,000		69,000
Total		13,225		13,500		23,685		25,625		296,081		278,326

Statement by counties of the vessels, boats, apparatus, shore property, and cash capital employed in the fisheries of Virginia—Continued.

Designation.	Mathews.				Middlesex.				Nansemond.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	16	$6,200	15	$6,000	5	$2,350	5	$2,350	32	$18,000	35	$15,600
Tonnage	171		162		40		40		328		349	
Outfit		3,817		3,878		654		604		7,823		8,166
Vessels transporting	30	32,000	30	32,100	10	11,900	10	11,900	8	3,800	8	3,800
Tonnage	747		745		303		303		68		68	
Outfit		4,588		4,588		1,356		1,307		755		755
Boats	788	38,175	783	38,100	827	39,650	827	39,650	209	11,430	209	11,430
Apparatus—vessel fisheries:												
Seines	2	1,300	2	1,300								
Lines				10								
Dredges	6	300	2	100								
Tongs	28	112	29	116	10	40	10	40	94	376	99	396
Apparatus—shore fisheries:												
Seines	12	180	12	180								
Pound nets	96	16,800	87	15,225	25	4,250	24	4,100	1	200	1	200
Gill nets	25	125	25	125								
Fyke nets									8	400	8	400
Miscellaneous nets		50		50								
Tongs, rakes, and nippers	808	4,322	808	4,322	1,506	10,264	1,506	10,264	350	1,400	350	1,400
Shore property		800		650		7,900		10,500		10,000		10,000
Cash capital						16,800		16,900		20,000		20,000
Total		108,769		106,744		95,164		97,615		74,184		72,147

Designation.	New Kent.				Norfolk.				Northampton.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value
Vessels fishing					164	$67,395	161	$66,695	29	$15,610	32	$16,870
Tonnage					1,537		1,495		298		316	
Outfit						45,223		44,358		2,350		3,425
Vessels transporting	2	$6,500	2	$6,500	41	38,900	41	35,900	13	11,810	18	15,825
Tonnage	110		110		801		777		200		258	
Outfit		284		354		6,631		6,666		1,650		1,750
Boats	117	1,583	117	1,583	442	30,685	433	29,415	302	18,105	332	19,990
Apparatus—vessel fisheries:												
Seines									1	700	1	700
Lines						10		20				
Dredges					2	100			4	190	6	270
Tongs					524	2,136	522	2,088	62	310	88	440
Apparatus—shore fisheries:												
Seines	4	775	4	775	2	800	2	800	6	1,200	6	1,200
Pound nets									21	19,115	22	19,840
Gill nets	623	2,249	623	2,249								
Fyke nets	10	125	10	125		400		425	14	1,120	16	1,280
Lines										215		228
Tongs, rakes, and nippers	17	65	18	70	835	3,340	816	3,264	473	1,445	502	1,540
Shore property		2,100		2,095		282,950		328,750		4,360		4,325
Cash capital						168,000		189,500		5,000		500
Total		13,681		13,751		646,570		707,881		83,180		88,183

Designation.	Northumberland.				Prince George.				Princess Anne.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	39	$40,650	44	$47,650								
Tonnage	836		930									
Outfit		11,273		14,865								
Vessels transporting	13	13,550	15	16,050								
Tonnage	276		323									
Outfit		1,501		1,614								
Boats	568	25,822	565	25,958	56	$745	56	$745	101	$2,090	101	$2,090
Apparatus—vessel fisheries:												
Seines	9	5,500	9	5,500								
Dredges	66	3,260	70	3,460								
Tongs	2	8	4	16								
Apparatus—shore fisheries:												
Seines	2	200	2	200	2	300	2	300	11	3,125	11	3,125
Pound nets	120	19,425	130	20,730					7	10,500	7	10,500
Gill nets					74	2,795	74	2,795	13	445	13	445
Miscellaneous nets		247		247		30		30				
Lines		150		150						75		75
Dredges	2	90	2	90								
Tongs, rakes, and nippers	566	2,699	536	2,619					50	75	50	75
Shore property		38,680		38,880		1,400		1,400		42,300		42,300
Cash capital		49,500		49,500						4,000		4,000
Total		212,555		227,529		5,270		5,270		62,610		62,610

Statement by counties of the vessels, boats, apparatus, shore property, and cash capital, etc.—Continued.

Designation.	Prince William.				Richmond.				Stafford.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing					6	$2,500	6	$2,500				
Tonnage					51		51					
Outfit						774		666				
Vessels transporting					4	1,655	4	5,600				
Tonnage					51		111					
Outfit						365		550				
Boats	37	$1,355	39	$1,455	283	9,174	283	8,894	39	$3,325	41	$3,385
Apparatus—vessel fisheries:												
Tongs					14	88	12	48				
Apparatus—shore fisheries:												
Seines									2	4,000	2	4,000
Pound nets	14	1,750	18	2,250	40	6,000	40	6,000	28	1,960	35	2,450
Gill nets	20	2,500	20	2,500	701	1,195	741	1,235	22	2,750	22	2,750
Fyke nets					6	90	6	90				
Tongs, rakes, and nippers					360	1,440	360	1,440				
Shore property						3,500		3,500		2,775		2,775
Cash capital						8,000		15,000				
Total		5,605		6,205		34,781		45,523		14,810		15,360

Designation.	Surry.				Warwick.				Westmoreland.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing					10	$3,700	11	$3,850	15	$6,850	18	$7,650
Tonnage					153		165		195		258	
Outfit						2,721		2,894		2,403		3,051
Vessels transporting					1	300	1	300	5	3,150	4	2,350
Tonnage					10		10		140		124	
Outfit						50		50		831		656
Boats	23	$650	23	$650	83	4,880	83	4,880	246	9,742	251	9,912
Apparatus—vessel fisheries:												
Dredges									30	1,450	36	1,730
Tongs					36	144	38	152				
Apparatus—shore fisheries:												
Seines	1	110	1	75							1	75
Pound nets					3	900	3	900	79	11,360	82	12,100
Gill nets	620	1,414	770	1,532					24	480	24	480
Miscellaneous nets										5		5
Lines		40		40		119		119		15		15
Dredges									26	1,235	26	1,235
Tongs, rakes, and nippers					128	512	128	512	283	1,415	283	1,415
Shore property		509		500		10,855		10,855				
Cash capital						200		300				
Total		2,714		2,797		24,381		24,812		38,936		40,674

Designation	York.				Total for State.			
	1890.		1891.		1890.		1891.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	68	$33,100	66	$32,600	730	$503,100	729	$498,440
Tonnage	739		715		9,110		9,087	
Outfit		9,900		9,521		172,549		169,933
Vessels transporting	2	2,800	2	2,800	211	246,705	214	241,695
Tonnage	80		80		5,124		5,084	
Outfit		437		437		29,280		29,068
Boats	294	15,758	294	15,758	9,153	457,038	9,247	463,722
Apparatus—vessel fisheries:								
Seines					42	26,250	41	25,650
Lines						10		30
Dredges					470	18,480	460	18,210
Tongs	163	652	158	632	1,324	6,323	1,367	6,482
Apparatus—shore fisheries:								
Seines					172	30,615	178	32,470
Pound nets	22	2,750	23	2,875	862	162,295	891	165,990
Gill nets					5,702	45,587	5,979	46,030
Fyke nets	124	1,550	124	1,550	335	5,585	339	5,770
Weirs					50	1,000	50	1,000
Miscellaneous nets						442		442
Lines		150		150		3,396		3,432
Pots					110	95	110	95
Spears					15	10	15	10
Dredges					182	3,995	198	4,640
Tongs, rakes and nippers	578	1,951	578	1,951	10,694	49,726	10,756	50,263
Shore property		1,145		1,145		664,095		717,787
Cash capital						444,800		467,500
Total		70,193		69,419		2,871,376		2,948,659

Statement by counties and species of the yield of the fisheries of Virginia.

Species.	Accomac.				Alexandria.				Caroline.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives	380,000	$1,890	310,000	$1,520	330,000	$2,550	389,600	$3,895	23,840	$239	25,500	$255
Bluefish	245,100	10,992	406,500	16,100								
Carp					800	32	1,460	58				
Catfish					13,730	403	9,820	285	10,040	305	12,600	380
Cobia or crab-eater	15,800	510	16,900	540								
Croakers	64,690	2,055	64,710	2,052								
Drum	75,490	1,663	75,220	1,780								
Eels	25,400	850	26,500	855					830	35	1,160	53
Flounders	37,580	1,231	41,785	1,380								
Kingfish and whiting	29,785	675	33,580	785								
Menhaden	33,458,700	59,389	25,155,700	43,055								
Mullet	62,500	1,250	68,000	1,360								
Perch	15,000	450	18,500	555	16,494	753	5,922	310	9,670	480	10,500	525
Pompano	9,850	815	11,500	860								
Sea bass	14,360	621	15,000	680								
Shad	93,030	3,850	104,125	4,213	258,300	6,990	254,500	6,275	27,815	795	22,575	645
Sheepshead	7,045	415	8,086	508								
Spanish mackerel	190,420	10,060	183,150	9,690								
Spots	121,900	4,020	125,950	4,020								
Squeteague	545,340	20,760	610,640	22,010								
Striped bass	12,310	1,205	17,000	1,470	9,016	901	4,260	403	500	50	1,000	100
Sturgeon	1,170	30	1,315	40								
Suckers	880	25	1,000	30	6,020	180	2,010	60	2,145	58	2,000	55
Other fish	264,590	6,231	277,264	6,360	1,240	41	1,938	82	10,860	307	15,710	400
Oysters	9,514,288	612,713	9,178,505	568,410								
Quahogs (hard clams)	280,368	18,915	291,160	19,035								
Crabs, hard	93,333	840	86,666	780								
Crabs, soft	305,200	14,475	450,916	18,015								
Terrapins	11,070	5,690	9,930	5,480								
Total	45,875,199	781,620	37,589,602	731,613	635,600	11,850	669,510	11,368	85,700	2,269	91,045	2,413

Species.	Elizabeth City.				Essex.				Fairfax.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives	151,130	$1,511	106,000	$1,060	168,200	$1,682	127,800	$1,278	807,659	$5,852	317,576	$3,649
Bluefish	153,286	7,383	114,170	5,385								
Carp									1,335	60	3,845	151
Catfish					118,400	3,484	94,780	2,888	40,000	1,320	95,085	2,961
Cobia or crab-eater	24,333	486	18,250	365								
Croakers	481,870	14,458	429,350	12,880								
Drum	71,905	1,815	61,282	1,541								
Eels	8,560	350	7,320	290	5,300	225	5,106	220	2,000	120	1,568	94
Flounders	42,880	1,340	44,000	1,235	300	12	200	8				
Kingfish and whiting	65,300	1,960	53,000	1,590								
Menhaden	12,579,000	21,253	11,412,000	19,224								
Mullet	12,000	240	8,500	170								
Perch	5,250	157	4,500	135	26,450	1,288	20,700	1,029	16,945	816	29,180	1,327
Pompano	49,600	4,960	37,200	3,720								
Sea bass	13,240	410	15,000	490								
Shad	598,111	20,506	428,165	14,680	227,552	6,496	178,500	5,097	478,495	14,218	342,504	10,942
Sheepshead	10,033	521	7,960	420								
Spanish mackerel	155,333	15,533	116,500	11,650								
Spots	306,125	9,183	305,500	9,165								
Squeteague	1,019,130	30,584	999,750	29,993	26,400	1,320	19,500	990				
Striped bass	16,400	1,640	12,400	1,240	52,850	4,565	45,300	3,726	9,035	765	11,920	967
Sturgeon	298,660	8,960	224,000	6,720	16,500	330	5,500	110	770	30	110	4
Suckers	2,000	40	3,000	60	4,365	110	3,450	93	11,365	341	12,600	377
Other fish	137,180	2,724	97,940	2,073	23,535	766	16,969	568	7,800	370	3,610	131
Oysters	2,712,220	173,005	2,874,480	168,988	262,500	15,000	315,000	15,000				
Quahogs (hard clams)	40,000	3,000	29,088	2,060								
Crabs, hard	1,057,250	6,766	679,375	8,696								
Crawfish											833	75
Turtles	156,250	3,125	136,250	2,725								
Total	20,167,046	331,910	18,224,980	306,495	932,352	35,278	832,805	31,007	1,375,404	23,892	818,831	20,678

Statement by counties and species of the yield of the fisheries of Virginia—Continued.

Species.	Charles City.				Chesterfield.				Dinwiddie.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives	300,961	$2,521	299,654	$2,510	395,000	$3,000	360,000	$2,650	44,600	$96	40,000	$90
Catfish	15,300	460	16,500	495	27,800	570	26,500	542				
Perch	32,384	1,092	28,315	964	65,000	1,950	62,000	1,760				
Pike	5,606	336	1,532	92	3,810	230	2,965	180				
Shad	400,267	10,942	319,581	9,228	109,375	2,812	76,562	1,868	42,234	1,086	37,334	960
Striped bass	17,924	1,695	14,522	1,409	5,000	500	4,000	400				
Sturgeon	38,701	1,281	34,520	993								
Other fish	221,078	5,073	201,541	4,667	123,390	2,620	109,535	2,258	11,600	219	11,100	209
Turtles	530	11	660	13								
Total	1,032,751	23,411	916,825	20,371	729,375	11,682	641,562	9,658	98,434	1,401	88,434	1,259

Species.	Gloucester.				Hanover.				Henrico.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives	455,500	$4,555	455,500	$4,555					314,500	$2,645	350,000	$2,700
Bluefish	55,500	1,660	57,600	1,728								
Catfish	5,000	150	5,400	162					9,960	212	8,800	182
Cobia or crab-eater	50,000	1,000	45,000	900								
Croakers	44,400	1,332	44,300	1,329								
Drum	8,000	320	8,500	340								
Flounders	3,200	160	4,200	210								
Kingfish and whiting	20,000	600	15,000	450								
Menhaden	500,000	1,000	500,000	1,000								
Mullet	15,000	375	18,000	450								
Perch	4,100	164	2,900	116					49,540	1,488	52,000	1,560
Pompano	25,000	2,500	23,000	2,300								
Shad	499,100	14,952	529,084	15,888	81,900	$2,457	65,520	$1,966	17,630	455	18,200	469
Spanish mackerel	25,000	2,500	35,000	3,500								
Spots	17,600	628	24,400	912								
Squeteague	116,600	3,498	111,800	3,354								
Striped bass	1,850	185	1,650	165					3,000	200	2,000	200
Sturgeon	75,000	1,875	78,000	1,950								
Suckers									22,985	500	24,200	528
Other fish	53,000	840	58,000	945					115,000	2,538	115,500	2,425
Oysters	2,463,510	159,585	2,453,717	144,583					35,000	2,450	35,000	2,250
Quahogs (hard clams)	20,320	1,270	20,256	1,266								
Crabs, hard	114,000	950	120,000	1,000								
Terrapins	16,113	8,692	15,280	8,152								
Turtles	15,000	450	19,000	462								
Total	4,602,793	209,241	4,645,587	195,717	81,900	2,457	65,520	1,966	567,615	10,488	605,700	10,314

Species.	Isle of Wight.				James City.				King and Queen.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives	5,000	$50	3,500	$35	20,328	$183	18,271	$165	78,300	$780	65,250	$652
Catfish	16,850	811	14,300	682	6,288	189	5,753	176	26,620	797	22,956	679
Croakers	125,000	5,000	122,000	4,880	7,005	282	7,995	318				
Drum	1,875	93	1,500	75								
Eels	3,125	312	2,500	250								
Menhaden	150,000	350	150,000	350								
Mullet	8,000	480	9,000	540								
Perch	40,075	2,372	34,440	2,020	24,385	930	20,627	776	25,648	826	21,172	675
Pike					1,206	72	1,155	69				
Shad	196,875	8,437	157,500	6,750	132,181	3,855	113,498	3,480	178,920	5,332	142,618	4,251
Sheepshead	3,125	187	2,500	150								
Spots	17,750	712	15,500	590								
Squeteague	40,377	1,531	33,500	1,285	9,000	360	8,199	327				
Striped bass	69,500	6,950	56,000	5,600	13,872	1,295	12,318	1,154	7,682	749	7,851	775
Sturgeon					81,525	3,076	64,060	2,251				
Suckers	3,840	115	4,120	120	17,838	485	14,556	432	13,538	394	12,968	360
Other fish	26,210	947	27,640	1,005	18,600	551	13,771	399	8,660	170	7,000	160
Oysters	821,030	42,742	780,549	41,013	122,500	7,300	126,000	7,500	52,500	3,000	52,150	3,080
Turtles					362	7	460	9				
Total	1,528,632	71,089	1,414,549	65,345	455,090	18,585	406,663	17,056	391,868	12,048	331,965	10,632

Statement by counties and species of the yield of the fisheries of Virginia—Continued.

Species.	King George.				King William.				Lancaster.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives	788,895	$8,891	627,163	$7,511	20,000	$200	25,000	$250	613,000	$4,215	620,225	$4,202
Bluefish									73,537	4,438	80,000	4,600
Carp	1,100	55	1,260	63								
Catfish	15,150	447	19,020	605	89,700	2,745	87,920	2,638				
Croakers									17,800	715	16,320	662
Eels	4,060	167	4,230	165								
Flounders									11,140	340	10,080	310
Menhaden									29,700,000	70,995	40,740,000	79,893
Perch	16,800	840	19,700	985								
Shad	237,580	6,788	215,654	5,795	314,884	9,421	252,210	7,544	606,665	24,091	610,750	24,480
Spanish mackerel									12,000	960	10,000	800
Spots									14,716	1,177	14,000	1,120
Squeteague									374,142	15,729	373,867	15,685
Striped bass	36,160	2,980	22,140	1,788	7,680	768	8,575	858				
Sturgeon	2,185	68	1,880	57					49,441	2,180	47,425	1,985
Suckers	8,510	255	9,390	282								
Other fish	65,445	3,388	74,880	3,875					126,505	3,047	120,600	2,903
Oysters					128,100	7,450	130,900	6,770	5,330,500	287,760	5,286,400	351,370
Crabs, hard	4,200	30	4,160	32	13,800	69	15,300	77				
Crabs, soft									81,440	8,144	80,000	8,000
Frogs	4,032	605	4,050	608								
Total	1,184,117	24,514	1,003,527	21,766	574,164	20,653	519,905	18,137	37,010,886	423,791	48,009,667	496,010

Species.	Mathews.				Middlesex.				Nansemond.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives	553,400	$5,534	538,800	$4,388	304,625	$2,916	270,000	$2,610	4,450	$128	4,000	$120
Bluefish	158,000	4,700	175,000	5,250								
Cobia or crab-eater	85,000	2,550	95,000	2,850								
Croakers									9,550	392	10,000	400
Menhaden	550,000	1,100	462,534	924								
Mullet	7,000	210	7,200	216								
Perch									1,000	40	800	32
Shad	651,000	19,530	588,000	17,540	131,250	3,750	108,500	3,100	1,655	84	1,575	81
Spanish mackerel	15,000	1,500	15,300	1,530								
Spots	3,500	105	3,000	90	9,164	366	9,125	700				
Squeteague	247,300	7,419	224,740	6,744	100,414	5,018	95,000	4,750	12,600	505	10,000	400
Striped bass					2,828	282	2,450	245	7,080	580	6,700	550
Sturgeon	147,000	2,940	130,500	2,610	10,332	310	10,000	300				
Other fish	59,000	1,770	44,500	1,335	22,500	675	26,250	795	2,700	108	2,500	100
Oysters	2,211,850	141,615	2,478,350	141,620	4,079,600	216,870	3,906,700	231,560	1,622,600	89,855	1,629,600	89,355
Quahogs (hard clams)	42,000	3,000	51,200	3,200								
Crabs, soft	19,200	1,200	14,400	900								
Terrapins	936	534	1,080	660								
Turtles	25,000	500	26,500	530								
Total	4,775,186	194,207	4,856,104	190,387	4,660,713	230,187	4,428,025	244,060	1,661,635	91,692	1,665,175	91,038

Species.	Prince William.				Richmond.				Stafford.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives	62,000	$610	79,200	$790	198,750	$1,988	150,000	$1,500	1,264,160	$10,889	1,053,300	$9,745
Carp	2,100	68	1,980	64					2,800	140	4,175	208
Catfish	2,050	66	2,710	92	119,750	3,665	94,250	2,907	9,800	392	19,700	591
Eels	1,500	60	1,820	70	4,980	180	4,265	150	2,785	140	2,430	120
Perch	7,315	284	7,865	286	29,812	1,491	21,750	1,088	34,285	1,410	37,242	1,575
Pike									3,920	280	4,820	337
Shad	102,620	2,932	84,400	2,360	183,312	5,237	134,575	3,845	64,400	1,990	55,200	1,805
Squeteague					32,500	1,950	24,375	1,462				
Striped bass	8,649	668	9,490	738	63,000	6,300	52,150	5,215	7,600	750	7,000	700
Sturgeon									150	5		
Suckers	520	16	720	21	2,175	52	1,845	43	2,346	72	1,955	59
Other fish	3,526	106	4,035	139	27,550	882	20,390	682	5,560	185	6,900	247
Oysters					941,800	48,630	851,200	55,250				
Frogs	15,000	1,875	15,600	1,950					600	75	690	86
Total	205,280	6,685	207,820	6,510	1,603,629	70,375	1,354,800	72,142	1,398,406	16,328	1,193,412	15,473

Statement by counties and species of the yield of the fisheries of Virginia—Continued.

Species.	New Kent.				Norfolk.				Northampton.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives	121,992	$1,172	104.986	$1,007					367,500	$1,029	1,269,000	$3,340
Bluefish					97,900	$3.350	137,280	$4,640	201,133	5,841	427,640	13,161
Catfish	20,450	614	17,623	533								
Cobia or crab-eater									19,404	252	20,100	293
Croakers					82,000	2,800	73,650	2,459	35,000	1,000	31,360	895
Drum									29,680	263	33,000	275
Eels									2,360	70	1,700	50
Flounders									2.835	36	3,420	45
Kingfish and whiting					10,000	1,000	7.000	700	4,971	125	3,895	103
Menhaden									237,213	472	230,000	460
Perch	25.142	748	22,210	666								
Pike	2,016	121	1,943	117								
Pompano									1,796	191	22,000	2,640
Sea bass									31,723	913	34,210	995
Shad	196,154	5,714	162,431	4,729					78,760	2,207	55,475	2,597
Sheepshead									572	43	3,400	170
Spanish mackerel									163,590	7,933	286,000	14,300
Spots					51,015	4,050	46.980	3,729	16,488	468	13,320	375
Squeteague					255,775	6,175	218,650	5,969	429,783	6,418	306,532	5,858
Striped bass	11,946	1,105	9,607	894					33,230	1,467	55,200	2,760
Sturgeon	4,754	190	4,280	171					2,100	18	1.950	20
Suckers	1,460	44	1,760	53								
Other fish	83.793	2,513	69,327	2,076					24,549	548	16.765	378
Oysters	48,300	2,587	50,400	2,700	4,051,677	233,540	4,013,415	228,400	2,599.226	125,774	3,627,792	167,756
Quahogs (hard clams)									65,280	4,135	63,936	4,049
Crabs, hard									540,166	13,450	633,430	15.735
Terrapins									2,000	800	1,600	700
Turtles	1,786	36	1,251	45								
Total	517,793	14,844	445.818	12,991	4,548,367	250,915	4,496,975	245,897	4,889,359	173,453	7,141,725	236,955

Species.	Northumberland.				Prince George.				Princess Anne.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives	1,406,238	$14.162	2,108,085	$21,064	151,370	$1,249	144,675	$1,197				
Bluefish	51,495	2.143	73,623	3,130					316,725	$11,379	316,220	$11,340
Carp	600	30	650	32								
Catfish	81,300	3,252	119,475	4,779								
Croakers	2,000	100	1,980	99					220,773	9,230	227,315	9,092
Eels	6.210	260	7,840	325								
Flounders	500	25	610	31								
Kingfish and whiting									35,000	3,500	34,090	3,409
Menhaden	30,090.000	54,933	27,262,100	52,532								
Perch	15,499	775	17.935	897	9,600	480	8,350	417				
Sea bass	2,000	100	2,100	105								
Shad	653,170	21,135	842,892	27.380	204,092	6,204	186,140	6,091				
Sheepshead	2,000	100	1,925	96								
Spanish mackerel									86,250	8,600	91,960	9,166
Spots	14.350	718	17,385	869					35,000	2,450	32,419	2,269
Squeteague	54,644	2,492	74,050	3,331					589,892	18,471	644,825	16,308
Striped bass	60,687	5,468	75,783	6,973	14,100	1,130	12,250	970				
Sturgeon	34.080	1,248	70,250	2.574	28,730	1,058	26,580	893				
Other fish	143,141	2,644	174,126	3,184	14.280	425	11,560	340	47,600	1,448	27,980	854
Oysters	2,135.000	121.647	2,023,700	120,160					87,607	27,825	89,999	28,450
Crabs, hard	23,400	180	25,500	195					668,645	5,300	675,000	5,350
Crabs, soft	33,900	2,155	39,600	2,360								
Terrapins					19,250	650	21,175	802				
Total	34.810,214	233,567	32,939,609	250.116	441,422	11,196	410,730	10,710	2,087,492	88,203	2,139,808	86,238

Statement by counties and species of the yield of the fisheries of Virginia—Continued.

Species.	Surry.				Warwick.				Westmoreland.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives					68,300	$512	53,300	$400	1,167,000	$9,875	1,047,100	$10,267
Bluefish					25,795	1,289	20,906	1,045	61,200	3,060	8,325	416
Catfish	292,314	$7,225	229,852	$5,808					19,400	726	32,200	1,102
Croakers					17,737	751	21,410	878				
Eels									4,820	250	5,180	265
Menhaden									76,800	96	68,000	85
Perch	9,200	460	7,500	375					11,420	571	14,725	736
Shad	202,765	8,364	152,834	6,375	16,800	480	12,810	366	216,900	6,157	190,865	5,114
Spanish mackerel					1,200	75	2,000	120				
Spots					13,865	579	12,278	491				
Squeteague					26,607	1,120	25,631	1,077	64,300	3,265	32,840	1,642
Striped bass	12,000	1,200	9,265	926	1,060	106	1,300	130	38,200	3,098	17,955	1,436
Sturgeon	16,572	765	13,276	536								
Suckers	4,900	118	5,530	135					13,180	385	15,260	445
Other fish	16,980	473	13,100	381	16,437	716	8,291	379	28,580	1,574	30,835	1,692
Oysters					963,060	37,056	996,793	34,298	583,485	42.755	516,250	43,650
Crabs, hard									70,000	625	68,640	818
Crabs, soft									600	80	1,040	104
Frogs									600	100	660	110
Total	554,731	18,605	431,357	14,536	1,150,861	42,684	1,154,719	39,184	2,356,485	72,617	2,049,875	67,882

Species.	York.				Total for State.			
	1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives	75, 000	$750	50, 000	$500	10, 641, 698	$91, 674	11, 013, 485	$93, 905
Bluefish	32, 000	960	25, 000	750	1, 471, 671	57, 195	1, 842, 264	67, 545
Carp					8, 735	385	13, 370	576
Catfish					939, 902	27, 833	935, 244	28, 487
Cobia, or crab-eater					194, 537	4, 798	195, 250	4, 948
Croakers	16, 700	530	25, 300	903	1, 124, 525	38, 645	1, 075, 690	36, 847
Drum					186, 950	4, 154	179, 502	4, 011
Eels					71, 930	3, 019	71, 619	2, 907
Flounders	27, 700	1, 065	23, 000	890	126. 135	4. 209	127, 295	4, 109
Kingfish and whiting	3, 000	60	3, 000	60	168, 056	7, 920	149, 565	7, 097
Menhaden					107, 341, 713	209, 588	105, 980, 334	197, 523
Mullet					104, 500	2, 555	110, 700	2, 736
Perch					491, 014	19, 865	468, 833	18, 809
Pike					16, 558	1, 039	12, 415	795
Pompano					86, 246	8, 466	93, 700	9, 520
Sea bass					61, 323	2, 044	66, 310	2, 270
Shad	62, 415	1, 630	53, 665	1, 450	7, 266, 207	228, 897	6, 498, 242	207, 394
Sheepshead					22, 775	1, 266	23, 871	1, 344
Spanish mackerel					648, 793	47, 161	739, 910	50, 756
Spots	30, 000	970	30, 300	945	651, 473	25, 426	650, 157	25, 275
Squeteague	127, 500	4, 125	116, 000	3, 460	4, 072, 304	130, 740	3, 929, 899	124, 645
Striped bass	6, 000	600	3, 350	335	529, 159	47, 202	483, 436	42. 127
Sturgeon	10, 000	150	10, 000	150	817, 670	24, 514	723, 646	21, 364
Suckers					118, 067	3, 190	116, 364	3, 153
Other fish	38, 600	1, 240	32, 100	963	1, 748, 889	45, 139	1, 641, 657	42, 005
Oysters	1, 751, 821	83. 189	1, 717, 702	72, 185	42, 518, 174	2, 482, 348	43, 134, 602	2, 524, 348
Quahogs (hard clams)	103, 920	6, 495	103, 638	6, 480	551, 888	36, 815	559, 278	36, 030
Crabs, hard					2, 584, 794	28, 210	2, 308, 071	32, 683
Crabs, soft					440, 340	26, 054	585, 956	29, 379
Crawfish							833	75
Frogs					20, 232	2, 655	21, 000	2, 754
Terrapins	3, 150	2, 700	3, 150	2, 700	52, 519	19, 066	52, 215	18, 494
Turtles	5, 000	150	5, 000	150	203, 928	4, 279	189, 121	3, 934
Total	2, 292, 206	104, 614	2, 201, 205	91, 921	185, 282, 705	3, 636, 351	183, 993, 834	3, 647, 845

The products taken with the different appliances.—The following tables, relating to the vessel fisheries and the boat fisheries, respectively, show the quantity and value of the products resulting from the use of each of the important forms of apparatus. Separate figures are given for each county; the data relate to 1890 and 1891.

Vessels are employed in the fisheries of 17 counties in Virginia, in all of which oysters constitute a conspicuous part of the yield. In Lancaster and Northumberland counties menhaden are the most valuable products taken. The aggregate value

of the vessel fisheries of the State in 1891 was $814,792, of which sum oysters represented $626,607 and fish $188,185. The output of oysters was 1,643,931 bushels, of which 490,230 bushels were taken with dredges and 1,153,701 bushels with tongs. The value of the vessel fisheries of Accomac and Norfolk counties was $427,022, or more than that of all the other counties combined.

The value of the shore fisheries of Virginia was $2,833,053. Omitting from consideration the apparatus used in taking oysters, it appears from the table that pound nets are much more important means of capture than any other appliances. These caught 23,796,835 pounds of fish in 1891, for which the fishermen received $471,560. The combined yield of fish by all other apparatus was 12,592,943 pounds, valued at $340,403. Alewives, menhaden, and shad constitute about two-thirds the quantity and more than one-third the value of the catch. Gill nets rank next to pound nets, followed by lines, seines, fyke nets, weirs, and pots. The shad is the most valuable fish in the pound-net and gill-net fisheries, the squeteague in the seine and line fisheries, and the striped bass in the fyke-net fishery.

Statement by counties, apparatus, and species of the yield of the vessel fisheries of Virginia.

Counties.	Seines.								Lines.			
	Bluefish.				Menhaden.				Bluefish.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Accomac					32,939,700	$57,614	24,620,700	$41,155				
Elizabeth City					11,715,000	19,525	10,800,000	18,000				
Lancaster					29,340,000	70,275	40,365,000	79,143			10,000	$400
Norfolk									1,650	$50	35,000	1,050
Northumberland			10,000	$300	27,360,000	50,250	24,900,000	47,750				
Total			10,000	300	101,354,700	197,664	100,685,700	186,048	1,650	50	45,000	1,450

Counties.	Lines.											
	Croakers.				Spots.				Squeteague.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Norfolk	2,500	$100	5,650	$169	1,015	$50	980	$49	5,775	$175	5,650	$169
Total	2,500	100	5,650	169	1,015	50	980	49	5,775	175	5,650	169

Counties.	Oysters by tongs.				Oysters by dredges.				Total value.	
	1890.		1891.		1890.		1891.		1890.	1891.
	Bushels.	Value.	Bushels.	Value.	Bushels.	Value.	Bushels.	Value.		
Accomac	203,740	$32,875	244,495	$40,740	429,810	$168,470	343,240	$182,600	$258,959	$264,495
Elizabeth City	45,000	21,575	48,400	21,280	34,960	17,680	37,240	17,458	58,780	56,738
Gloucester	56,930	22,609	65,450	24,965					22,609	24,965
Henrico	5,000	2,450	5,000	2,250					2,450	2,250
Isle of Wight	35,620	10,957	29,400	8,412					10,957	8,412
King William	15,300	6,100	15,700	5,570					6,100	5,570
Lancaster	2,500	1,060	4,700	1,970	2,000	900	2,000	800	72,235	82,313
Mathews	14,850	6,645	18,600	7,440	4,900	2,310	3,000	1,200	8,955	8,640
Middlesex	4,200	1,950	4,100	2,010					1,950	2,010
Nansemond	86,800	34,205	92,800	35,605					34,205	35,605
Norfolk	408,161	163,930	407,570	161,090	7,000	3,150			167,455	162,527
Northampton	62,750	15,565	90,300	24,285	7,900	4,000	10,650	5,690	19,565	29,975
Northumberland	600	270	1,600	720	70,900	28,705	66,600	29,930	79,225	78,700
Richmond	5,600	2,270	2,800	1,250					2,270	1,250
Warwick	22,000	8,252	23,700	7,545					8,252	7,515
Westmoreland					30,705	16,319	27,500	16,500	16,319	16,500
York	107,300	33,785	99,086	27,297					33,785	27,297
Total	1,076,351	364,498	1,153,701	372,429	588,175	241,534	490,230	254,178	804,071	814,792

Statement by counties, apparatus, and species of the yield of the shore fisheries of Virginia.

Apparatus and species.	Accomac.				Alexandria.				Caroline.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Alewives					320,000	$2,450	388,000	$3,875	5,000	$50	10,000	$100
Carp					800	32	1,460	58				
Catfish					13,730	403	9,820	285	1,000	30	2,000	60
Croakers	23,300	$815	20,000	$700								
Flounders	3,800	114	4,000	120								
Kingfish and whiting	1,985	50	2,160	65								
Menhaden	95,000	950	100,000	1,000								
Mullet	62,500	1.250	68,000	1,360								
Perch	12,000	360	15,000	450	16,494	753	5,922	310	1,300	65	2,500	125
Sea bass	5,600	316	6,000	360								
Shad					11,900	300	32,000	760				
Spots	76,000	2,280	80,000	2,400								
Squeteague	147,690	4,415	156,640	4,695								
Striped bass					9,016	901	4,260	403	500	50	1,000	100
Suckers					6,020	180	2,010	60				
Other fish	7,025	220	6,200	190	1,040	31	1,878	79	5,035	107	10,070	215
Total	434,900	10,770	458,000	11,340	379,000	5,050	445,350	5,830	12,835	302	25,570	600
Pound nets:												
Alewives	380,000	1,890	310,000	1,520	10,000	100	1,600	20	18,840	189	15,500	155
Bluefish	168,100	8,142	320,500	12,820								
Catfish									9,040	275	10,600	320
Cobia or crab-eater	15,800	510	16,900	540								
Croakers	28,500	740	30,210	787								
Drum	48,330	748	46,000	700								
Eels	21,200	640	23,000	680					830	35	1,160	53
Flounders	18,710	550	21,285	630								
Kingfish and whiting	7,300	215	8,920	270								
Menhaden	424,000	825	435,000	900								
Perch									8,370	415	8,000	400
Pompano	9,850	815	11,500	860								
Shad	93,030	3,850	104,125	4,243	1,400	40	500	15	1,575	45	1,575	45
Sheepshead	4,900	240	6,100	350								
Spanish mackerel	177,420	8,960	170,650	8,640								
Spots	23,400	700	26,450	760								
Squeteague	217,650	8,545	246,000	8,865								
Striped bass	11,690	1,180	16,500	1,450								
Sturgeon	1,170	30	1,315	40								
Suckers									2,145	58	2,000	55
Other fish	174,790	3,077	189,270	3,293	200	10	60	3	5,825	200	5,640	185
Total	1,825,840	41,657	1,983,725	47,348	11,600	150	2,160	38	46,625	1,217	44,475	1,213
Gill nets:												
Bluefish	52,000	1,750	56,000	1,980								
Shad					245,000	6,650	222,000	5,500	26,240	750	21,000	600
Spanish mackerel	13,000	1,100	12,500	1,050								
Spots	12,500	540	11,500	460								
Squeteague	35,000	1,600	38,000	1,850								
Other fish	45,000	1,820	51,500	2,100								
Total	157,500	6,810	169,500	7,440	245,000	6,650	222,000	5,500	26,240	750	21,000	600
Fyke nets:												
Flounders	1,800	36	1,500	30								
Perch	3,000	90	3,500	105								
Striped bass	620	25	500	20								
Suckers	880	25	1,000	30								
Total	6,300	176	6,500	185								
Lines:												
Bluefish	25,000	1,100	30,000	1,300								
Croakers	12,890	500	14,500	565								
Drum	27,160	915	29,220	1,080								
Flounders	13,270	531	15,000	600								
Kingfish and whiting	20,500	410	22,500	450								
Sea bass	8,760	305	9,000	320								
Sheepshead	2,145	175	1,986	158								
Spots	10,000	500	8,000	400								
Squeteague	145,000	6,200	170,000	6,600								
Other fish	37,775	1,114	30,294	777								
Total	302,500	11,750	330,500	12,250								

Statement by counties, apparatus, and species of the yield of the shore fisheries of Virginia—Continued.

Apparatus and species.	Accomac.				Alexandria.				Caroline.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Pots and spears:												
Eels	4,200	$210	3,500	$175								
Miscellaneous:												
Oysters	5,079,438	411,368	5,064,360	345,070								
Quahogs	280,368	18,915	291,160	19,035								
Crabs, hard	93,333	840	86,666	780								
Crabs, soft	305,200	14,475	450,916	18,015								
Terrapins	11,070	5,690	9,930	5,480								
Total	5,769,409	451,288	5,903,032	388,380								
Grand total	8,500,649	522,661	8,854,757	467,118	635,600	$11,850	669,510	$11,368	85,700	$2,269	91,045	$2,413

Apparatus and species.	Isle of Wight.				James City.				King and Queen.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Alewives					10,828	$97	9,671	$87	78,300	$780	65,250	$652
Catfish	600	$24	800	$32					18,250	546	15,000	450
Perch	2,200	100	3,940	190	526	16	455	14	14,500	435	12,500	375
Shad					931	27	854	25				
Striped bass					319	26	266	21	4,520	452	5,315	531
Sturgeon					975	39	820	33				
Suckers	3,840	115	4,120	120								
Other fish	5,960	265	9,940	410	700	21	665	20				
Total	12,600	504	18,800	752	14,279	226	12,731	200	115,570	2,213	98.065	2,008
Gill nets:												
Alewives					9,500	86	8,600	78				
Menhaden	150,000	350	150,000	350								
Mullet	8,000	480	9,000	540								
Perch	31,000	1,860	25,000	1,500	15,783	603	12,147	455	7,620	285	5.000	190
Pike					1,206	72	1,155	69				
Shad	196,875	8,437	157,500	6,750	131,250	3,828	112,644	3,455	178,920	5,332	142,618	4,251
Striped bass	62,000	6,200	50,000	5,000	4,310	345	3,493	278	930	74	700	60
Sturgeon					80,550	3,037	63,240	2,218				
Suckers					16,962	459	13,500	400	10,910	315	9,800	265
Other fish					17,900	530	13,106	379	8,660	170	7,000	160
Total	447,875	17,327	391,500	14,140	277,461	8,960	227,885	7,332	207,040	6,176	165,118	4,926
Fyke nets:												
Alewives	5,000	50	3,500	35								
Catfish	5,000	225	4,500	200	6,288	189	5,753	176	8,370	251	7,956	229
Croakers					7,005	282	7,995	318				
Perch	2,500	150	2,000	120	8,076	311	8,025	307	3,528	106	3,672	110
Squeteague					9,000	360	8,199	327				
Striped bass	3,750	375	3,000	300	9,243	924	8,559	855	2,232	223	1,836	184
Suckers					876	26	1,056	32	2,628	79	3,168	95
Other fish	1,500	45	1,500	45								
Total	17,750	845	14,500	700	40,488	2,092	39,587	2,015	16,758	659	16,632	618
Lines:												
Catfish	11,250	562	9,000	450								
Croakers	125,000	5,000	122,000	4,880								
Drum	1,875	93	1,500	75								
Perch	4,375	262	3,500	210								
Sheepshead	3,125	187	2,500	150								
Spots	17,750	712	15,500	590								
Squeteague	40,377	1,531	33,500	1,285								
Striped bass	3,750	375	3,000	300								
Other fish	18,750	637	16,200	550								
Total	226,252	9,359	206,700	8,490								
Pots and spears:												
Eels	3,125	312	2,500	250								
Miscellaneous:												
Oysters	571,690	31,785	574,749	32,601	122,500	7,300	126,000	7,500	52,500	3,000	52,150	3,080
Turtles					362	7	460	9				
Total	571,690	31,785	574,749	32,601	122,862	7,307	126.460	7,509	52,500	3,000	52,150	3,080
Grand total	1,279,292	60,132	1,208,749	56,933	455,090	18,585	406,663	17,056	391,868	12,048	331,965	10,632

Statement by counties, apparatus, and species of the yield of the shore fisheries of Virginia—Continued.

Apparatus and species.	Charles City.				Chesterfield.				Dinwiddie.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Alewives	150,961	$1,021	149,654	$1,010	45,000	$450	35,000	$350	32,000	$70	30,000	$65
Catfish	12,000	360	13,000	390	25,000	500	24,000	480				
Perch	25,720	892	24,705	856	20,000	600	15,000	450				
Shad	99,092	2,551	65,161	1,678					31,734	816	28,000	720
Striped bass	6,419	634	6,226	615	5,000	500	4,000	400				
Sturgeon	1,401	56	1,320	53								
Other fish	98,920	2,038	83,915	1,738	17,000	660	15,000	450	10,500	200	10,000	190
Total	394,513	7,552	343,981	6,340	112,000	2,710	93,000	2,130	74,234	1,086	68,000	975
Gill nets:												
Alewives	150,000	1,500	150,000	1,500	350,000	2,550	325,000	2,300	12,600	26	10,000	25
Catfish					2,800	70	2,500	62				
Perch	6,664	200	3,610	108	45,000	1,350	47,000	1,310				
Pike	5,606	336	1,532	92	3,810	230	2,965	180				
Shad	301,175	8,391	254,420	7,550	109,375	2,812	76,562	1,868	10,500	270	9,334	240
Striped bass	4,505	361	1,796	144								
Sturgeon	37,300	1,225	33,200	940								
Other fish	122,158	3,035	117,626	2,929	106,390	1,960	94,535	1,808	1,100	19	1,100	19
Total	627,408	15,048	562,184	13,263	617,375	8,972	548,562	7,528	24,200	315	20,434	284
Lines:												
Catfish	3,300	100	3,500	105								
Striped bass	7,000	700	6,500	650								
Total	10,300	800	10,000	755								
Miscellaneous:												
Turtles	530	11	660	13								
Grand total	1,032,751	23,411	916,825	20,371	729,375	11,682	641,562	9,658	98,434	1,401	88,434	1,259

Apparatus and species.	King George.				King William.				Lancaster.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Alewives	130,000	$1,300	120,500	$1,455								
Catfish	1,650	50	3,500	117								
Perch	4,000	200	5,200	260								
Shad	26,250	750	18,000	550								
Striped bass	10,000	800	12,700	1,016								
Other fish	28,000	1,400	25,800	1,290								
Total	199,900	4,500	185,700	4,688								
Pound nets:												
Alewives	658,895	7,591	506,663	6,056	20,000	$200	25,000	$250	613,000	$4,215	620,225	$4,202
Bluefish									73,537	4,438	70,000	4,200
Carp	1,100	55	1,260	63								
Catfish	13,500	397	15,520	488	3,500	105	3,300	99				
Croakers									17,800	715	16,320	662
Eels	4,060	167	4,230	165								
Flounders									11,140	340	10,080	310
Menhaden									360,000	720	375,000	750
Perch	12,800	640	14,500	725								
Shad	106,330	3,038	113,654	2,845	6,184	159	5,250	135	606,665	24,091	610,750	24,480
Spanish mackerel									12,000	960	10,000	800
Spots									14,716	1,177	14,000	1,120
Squeteague									374,142	15,729	373,867	15,685
Striped bass	26,160	2,180	9,440	772	2,000	200	2,300	230				
Sturgeon	2,185	68	1,880	57					49,441	2,180	47,425	1,985
Suckers	8,510	255	9,390	282								
Other fish	37,445	1,988	49,080	2,585					126,505	3,047	120,600	2,903
Total	870,985	16,379	725,617	14,038	31,684	664	35,850	714	2,258,946	57,612	2,268,267	57,097
Gill nets:												
Shad	105,000	3,000	84,000	2,400	308,700	9,262	246,960	7,409				
Lines:												
Catfish					86,200	2,640	84,620	2,539				
Striped bass					5,680	568	6,275	628				
Total					91,880	3,208	90,895	3,167				
Miscellaneous:												
Oysters					21,000	1,350	21,000	1,200	5,299,000	285,800	5,239,500	348,600
Crabs, hard	4,200	30	4,160	32	13,800	69	15,300	77				
Crabs, soft									81,440	8,144	80,000	8,000
Frogs	4,032	605	4,050	608								
Total	8,232	635	8,210	640	34,800	1,419	36,300	1,277	5,380,440	293,944	5,319,500	356,600
Grand total	1,184,117	24,514	1,003,527	21,766	467,064	14,553	410,005	12,567	7,639,386	351,556	7,587,767	413,697

Statement by counties, apparatus, and species of the yield of the shore fisheries of Virginia—Continued.

Apparatus and species.	Elizabeth City.				Essex.				Fairfax.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Alewives					8,000	$80	7,000	$70	609,659	$3,872	93,610	$980
Bluefish	7,800	$390	4,500	$225								
Carp									1,335	60	1,045	47
Catfish					5,000	150	2,500	75	12,000	480	10,875	435
Drum	1,200	60	600	30								
Eels									2,000	120	1,568	94
Mullet	12,000	240	8,500	170								
Perch									4,345	186	3,780	161
Shad									264,460	8,624	182,280	6,904
Spots	2,300	69	1,500	45								
Squeteague	3,500	105	2,500	75								
Striped bass	2,000	200	1,500	150	500	50	400	40	3,435	275	3,660	293
Sturgeon									770	30	110	4
Suckers									7,165	215	6,000	190
Other fish	4,100	82	2,300	46	4,000	200	4,000	200	800	20	880	22
Total	32,900	1,146	21,400	741	17.500	480	13,900	385	905,969	13,882	303,808	9,130
Pound nets:												
Alewives	151,130	1,511	106,000	1,060	159,000	1.590	120,000	1,200	198,000	1,980	223,966	2,669
Bluefish	114,666	5,833	76,000	3,800								
Carp											2,800	104
Catfish					90,000	2,700	69,000	2,070	28,000	840	84,210	2,526
Cobia or crab-eater	24,333	486	18,250	365								
Croakers	62,660	1,880	47,350	1,420								
Drum	34,395	1,030	29,840	895								
Eels	8,560	350	7,320	290	3,800	150	3,281	130				
Flounders	28.315	850	27,100	715								
Kingfish and whiting	65,300	1,960	53,000	1,590								
Menhaden	864,000	1,728	612,000	1,224								
Perch					23,850	1,170	17,400	870	12,600	630	25,400	1,166
Pompano	49,600	4,960	37,200	3,720								
Shad	598,111	20,506	428,165	14,680	22,050	630	15,750	450	13,335	381	10,520	263
Sheepshead	8,933	446	6,700	335								
Spanish mackerel	155,333	15,533	116,500	11,650								
Spots	44,500	1,335	35,500	1,065								
Squeteague	166,330	5,000	117,250	3,518	26,400	1,320	19,500	990				
Striped bass	14,400	1,440	10,900	1,090	45,000	3,840	36,000	2,880	3,500	280	7,560	604
Sturgeon	298,660	8,960	224,000	6,720								
Suckers					2,765	70	2,450	63	4,200	126	6,600	187
Other fish	111,380	1,990	67,740	1,190	18,335	530	12,269	347	7,000	350	2,730	109
Total	2,800,606	75,798	2,020,815	55,327	391,200	12,000	295,650	9,000	266,635	4,587	363,786	7,628
Gill nets:												
Shad					203,752	5,821	161,700	4,620	200,700	5,213	149,704	3,775
Striped bass					5,350	535	6,100	610	2,100	210	700	70
Sturgeon					16,500	330	5,500	110				
Total					225,602	6,686	173,300	5,340	202,800	5.423	150,404	3,845
Fyke nets:												
Alewives					1,200	12	800	8				
Catfish					1,400	84	1,500	9				
Croakers	2,800	84	2,000	60								
Flounders					300	12	200	8				
Perch	5,250	157	4,500	135	2,600	118	3.300	159				
Shad					1,750	45	1,050	27				
Spots	4,200	126	3,500	105								
Squeteague	6,800	204	5,000	150								
Striped bass					2,000	140	2,800	196				
Suckers	2,000	40	3,000	60	1,600	40	1,000	30				
Other fish					1.200	36	700	21				
Total	21,050	611	18,000	510	12,050	487	11,350	539				
Lines:												
Bluefish	30,820	1,160	33,670	1,360								
Catfish					22,000	550	21,780	653				
Croakers	416,410	12,494	380,000	11,400								
Drum	36,310	725	30,842	616								
Flounders	14,565	490	16,900	520								
Sea bass	13,240	410	15,000	490								
Sheepshead	1,100	75	1 260	85								
Spots	255,125	7,653	265,000	7,950								
Squeteague	842,500	25,275	875,000	26,250								
Other fish	21,700	652	27,900	837								
Total	1,631,770	48,934	1,645,572	49,508	22,000	550	21,780	653				

Statement by counties, apparatus, and species of the yield of the shore fisheries of Virginia—Continued.

Apparatus and species.	Elizabeth City.				Essex.				Fairfax.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Pots and spears:												
Eels					1,500	$75	1,825	$90				
Miscellaneous:												
Oysters	2,152,500	$133,750	2,275,000	$130,250	262,500	15,000	315,000	15,000				
Quahogs	40,000	3,000	29,088	2,000								
Crabs, hard	1,057,250	6,766	679,375	8,696								
Crawfish											833	$75
Turtles	156,250	3,125	136,250	2,725								
Total	3,406,000	146,641	3,119,713	143,671	262,500	15,000	315,000	15,000			833	75
Grand total.	7,892,326	273,130	6,825,500	249,757	932,352	35,278	832,805	31,007	1,375,404	$23,892	818,831	20,678

Apparatus and species.	Mathews.				Middlesex.				Nansemond.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Mullet	7,000	$210	7,200	$216								
Other fish	3,000	90	3,000	90								
Total	10,000	300	10,200	306								
Pound nets:												
Alewives	550,400	5,504	535,000	4,350	304,625	$2,916	270,000	$2,610				
Bluefish	158,000	4,700	175,000	5,250								
Cobia or crab-eater	85,000	2,550	95,000	2,850								
Menhaden	550,000	1,100	462,534	924								
Shad	651,000	19,530	588,000	17,540	131,250	3,750	108,500	3,100	990	$50	875	$45
Spanish mackerel	15,000	1,500	15,300	1,530								
Spots					9,164	366	9,125	700				
Squeteague	244,000	7,320	221,000	6,630	100,414	5,018	95,000	4,750				
Striped bass					2,828	282	2,450	245	800	80	700	70
Sturgeon	147,000	2,940	130,500	2,610	10,332	310	10,000	300				
Other fish	55,000	1,650	40,000	1,200	22,500	675	26,250	795	2,700	108	2,500	100
Total	2,455,400	46,794	2,262,334	42,884	581,113	13,317	521,325	12,500	4,490	238	4,075	215
Gill nets:												
Alewives	3,000	30	3,800	38								
Spots	3,500	105	3,000	90								
Squeteague	3,300	99	3,740	114								
Other fish	1,000	30	1,500	45								
Total	10,800	264	12,040	287								
Fyke nets:												
Alewives									4,450	128	4,000	120
Croakers									9,550	392	10,000	400
Perch									1,000	40	800	32
Shad									665	34	700	36
Squeteague									12,600	505	10,060	400
Striped bass									6,280	500	6,000	480
Total									34,545	1,599	31,500	1,468
Miscellaneous:												
Oysters	2,073,600	132,660	2,327,150	132,980	4,050,200	214,920	3,878,000	229,550	1,015,000	55,650	980,000	53,750
Quahogs	42,000	3,000	51,200	3,200								
Crabs, soft	19,200	1,200	14,400	900								
Terrapins	936	534	1,080	660								
Turtles	25,000	500	26,500	530								
Total	2,160,736	137,894	2,420,330	138,270	4,050,200	214,920	3,878,000	229,550	1,015,000	55,650	980,000	53,750
Grand total	4,636,936	185,252	4,704,904	181,747	4,631,313	228,237	4,399,325	242,050	1,054,035	57,487	1,015,575	55,433

Statement by counties, apparatus, and species of the yield of the shore fisheries of Virginia—Continued.

Apparatus and species.	Gloucester.				Hanover.				Henrico.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Alewives									43,000	$230	65,000	$350
Catfish									8,960	182	8,000	160
Mullet	15,000	$375	18,060	$450								
Perch									4,540	138	5,000	150
Squeteague	12,000	360	15,000	450								
Striped bass									3,000	200	2,000	200
Other fish	3,000	90	5,000	150					2,500	150	2,000	80
Total	30,000	825	38,000	1,050					62,000	900	82,000	940
Pound nets:												
Alewives	430,500	4,305	435,500	4,355								
Bluefish	39,800	1,194	40,800	1,224								
Cobia or crab-eater	50,000	1,000	45,000	900								
Croakers	38,500	1,155	38,000	1,140								
Drum	8,000	320	8,500	340								
Kingfish and whiting	20,000	600	15,000	450								
Menhaden	500,000	1,000	500,000	1,000								
Pompano	25,000	2,500	23,000	2,300								
Shad	492,100	14,762	522,784	15,718								
Spanish mackerel	25,000	2,500	35,000	3,500								
Spots	10,000	400	18,000	720								
Squeteague	75,800	2,274	70,800	2,124								
Sturgeon	75,000	1,875	78,000	1,950								
Other fish	50,000	750	53,000	795								
Total	1,839,700	34,635	1,883,384	36,516								
Gill nets:												
Alewives	25,000	250	20,000	200					260,000	2,300	275,000	2,250
Bluefish	13,000	390	14,500	435								
Catfish									1,000	30	800	22
Perch									45,000	1,350	47,000	1,410
Shad	3,500	100	2,800	80	81,900	$2,457	65,520	$1,966	17,500	450	18,084	465
Squeteague	18,000	540	16,500	495								
Suckers									4,000	120	4,200	128
Other fish									90,000	1,800	88,500	1,720
Total	59,500	1,280	53,800	1,210	81,900	2,457	65,520	1,966	417,500	6,050	433,584	5,995
Fyke nets:												
Catfish	5,000	150	5,400	162								
Croakers	4,500	135	5,300	159								
Flounders	3,200	160	4,200	210								
Perch	4,100	164	2,900	116								
Shad	3,500	90	3,500	90								
Spots	6,300	189	5,200	156								
Squeteague	8,300	249	7,500	225								
Striped bass	1,850	185	1,650	165								
Total	36,750	1,322	35,650	1,283								
Weirs.												
Alewives									11,500	115	10,000	100
Shad									130	5	116	4
Suckers									18,985	380	20,000	400
Other fish									22,500	588	25,000	625
Total									53,115	1,088	55,116	1,129
Lines:												
Bluefish	2,700	76	2,300	69								
Croakers	1,400	42	1,000	30								
Spots	1,300	39	1,200	36								
Squeteague	2,500	75	2,000	60								
Total	7,900	232	6,500	195								
Miscellaneous:												
Oysters	2,065,000	136,976	1,995,567	119,618								
Quahogs	20,320	1,270	20,256	1,266								
Crabs, hard	114,000	950	120,000	1,000								
Terrapins	16,113	8,692	15,280	8,152								
Turtles	15,000	450	19,000	462								
Total	2,230,433	148,338	2,170,103	130,498								
Grand total	4,204,283	186,632	4,187,437	170,752	81,900	2,457	65,520	1,966	532,615	8,038	570,700	8,064

Statement by counties, apparatus, and species of the yield of the shore fisheries of Virginia—Continued.

Apparatus and species.	New Kent.				Norfolk.				Northampton.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Alewives	121, 902	$1, 172	104, 986	$1, 007								
Bluefish					51, 250	$1, 800	50, 000	$1, 750	33, 210	$1, 023	24, 000	$720
Catfish	15, 800	474	13, 200	400								
Croakers					30, 000	1, 200	25, 000	1, 000				
Kingfish and whiting					10, 000	1, 000	7, 000	700	2, 240	57	1, 685	40
Perch	18, 493	555	16, 220	489								
Shad	4, 050	116	3, 703	105					2, 103	85	1, 575	67
Spots					10, 000	800	8, 000	640	9, 640	190	6, 700	134
Squeteague					100, 000	3, 000	95, 000	2, 850	17, 380	518	11, 000	375
Striped bass	7, 777	747	6, 506	625					4, 360	220	3, 100	155
Sturgeon	4, 754	190	4, 280	171								
Other fish	3, 240	97	3, 160	94					3, 860	67	1, 615	26
Total	176, 106	3, 351	152, 155	2, 891	201, 250	7, 800	185, 000	6, 940	72, 793	2, 160	49, 675	1, 517
Pound nets:												
Alewives									367, 500	1, 029	1, 269, 000	3, 340
Bluefish									147, 923	4, 068	380, 000	11, 600
Cobia or crab-eater									19, 404	252	20, 100	293
Eels									2, 360	70	1, 700	50
Drum									29, 680	263	33, 000	275
Flounders									2, 835	36	3, 420	45
Kingfish and whiting									2, 731	68	2, 210	63
Menhaden									237, 213	472	230, 000	460
Pompano									1, 796	191	22, 000	2, 640
Sea bass									1, 113	8	1, 340	10
Shad									68, 712	1, 766	46, 200	2, 200
Sheepshead									572	43	3, 400	170
Spanish mackerel									163, 590	7, 933	286, 000	14, 300
Spots									1, 848	28	2, 620	41
Squeteague									352, 388	4, 099	231, 082	3, 550
Striped bass									19, 390	773	44, 600	2, 200
Sturgeon									2, 100	18	1, 950	20
Other fish									5, 819	132	2, 660	60
Total									1, 426, 974	21, 249	2, 580, 682	41, 317
Gill nets:												
Perch	4, 684	140	3, 850	116								
Pike	2, 016	121	1, 943	117								
Shad	192, 104	5, 598	158, 728	4, 624								
Striped bass	2, 929	234	2, 082	167								
Other fish	80, 553	2, 416	66, 167	1, 982								
Total	282, 286	8, 509	232, 770	7, 006								
Fyke nets:												
Catfish	4, 650	140	4, 423	133								
Perch	1, 965	53	2, 040	61								
Shad									7, 945	356	7, 700	330
Squeteague									10, 015	301	9, 450	283
Striped bass	1, 240	124	1, 019	102					9, 480	474	8, 100	405
Suckers	1, 460	44	1, 760	53								
Other fish									10, 610	214	8, 600	172
Total	9, 315	361	9, 242	349					38, 050	1, 345	33, 850	1, 190
Lines:												
Bluefish					45, 000	1, 500	52, 280	1, 840	20, 000	750	23, 640	841
Croakers					49, 500	1, 500	43, 000	1, 290	35, 000	1, 000	31, 360	895
Sea bass									30, 610	905	32, 870	985
Spots					40, 000	3, 200	38, 000	3, 040	5, 000	250	4, 000	200
Squeteague					150, 000	3, 000	118, 000	2, 950	50, 000	1, 500	55, 000	1, 650
Other fish									4, 260	135	3, 890	120
Total					284, 500	9, 200	251, 280	9, 120	144, 870	4, 540	150, 760	4, 691
Miscellaneous:												
Oysters	48, 300	2, 587	50, 400	2, 700	1, 145, 550	66, 460	1, 160, 425	67, 310	2, 104, 676	106, 209	2, 921, 142	137, 781
Quahogs									65, 280	4, 135	63, 936	4, 049
Crabs, hard									540, 166	13, 450	633, 430	15, 735
Terrapins									2, 000	800	1, 600	700
Turtles	1, 786	36	1, 251	45								
Total	50, 086	2, 623	51, 651	2, 745	1, 145, 550	66, 460	1, 160, 425	67, 310	2, 712, 122	124, 594	3, 620, 108	158, 265
Grand total	517, 793	14, 844	445, 818	12, 991	1, 631, 300	83, 460	1, 596, 705	83, 370	4, 394, 809	153, 888	6, 435, 075	206, 980

Statement by counties, apparatus, and species of the yield of the shore fisheries of Virginia—Continued.

Apparatus and species.	Northumberland.				Prince George.				Princess Anne.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Alewives					2,870	$29	2,675	$27				
Bluefish									175,000	$6,125	165,320	$5,786
Carp	600	$30	650	$32								
Croakers									108,773	4,750	112,315	4,492
Kingfish and whiting									35,000	3,500	34,090	3,409
Shad					18,592	557	16,275	552				
Spots	2,400	120	2,600	130					35,000	2,450	32,419	2,269
Squeteague	5,000	250	5,120	256					353,714	12,399	402,325	10,058
Striped bass	12,000	600	12,100	605								
Other fish					10,000	300	8,000	240	1,400	50	1,940	58
Total	20,000	1,000	20,470	1,023	31,462	886	26,950	819	708,887	29,274	748,409	26,072
Pound nets:												
Alewives	1,406,238	14,162	2,108,085	21,064								
Bluefish	46,495	1,893	58,773	2,588					130,000	4,550	140,000	4,900
Catfish	81,300	3,252	119,475	4,779								
Croakers									112,000	4,480	115,000	4,600
Eels	6,210	260	7,840	325								
Menhaden	2,730,000	4,683	2,362,100	4,782								
Perch	15,499	775	17,935	897								
Shad	653,170	21,135	842,892	27,380								
Spanish mackerel									85,000	8,500	90,460	9,046
Spots	1,950	98	3,185	159								
Squeteague	36,644	1,592	55,650	2,411					225,000	5,625	230,000	5,750
Striped bass	44,687	4,468	59,583	5,958								
Sturgeon	34,080	1,248	70,250	2,574								
Other fish	141,641	2,569	172,601	3,108					45,000	1,350	24,540	736
Total	5,197,914	56,135	5,878,369	76,025					597,000	24,505	600,000	25,032
Gill nets:												
Alewives					148,500	1,220	142,000	1,170				
Bluefish									11,725	704	10,900	654
Perch					9,600	480	8,350	417				
Shad					185,500	5,647	169,865	5,539				
Spanish mackerel									1,250	100	1,500	120
Squeteague									11,178	447	12,500	500
Striped bass					14,100	1,130	12,250	970				
Sturgeon					28,730	1,058	26,580	893				
Other fish					4,280	125	3,560	100	1,200	48	1,500	60
Total					390,710	9,660	362,605	9,089	25,353	1,299	26,400	1,334
Lines:												
Bluefish	5,000	250	4,850	242								
Croakers	2,000	100	1,980	99								
Flounders	500	25	610	31								
Sea bass	2,000	100	2,100	105								
Sheepshead	2,000	100	1,925	96								
Spots	10,000	500	11,600	580								
Squeteague	13,000	650	13,280	664								
Striped bass	4,000	400	4,100	410								
Other fish	1,500	75	1,525	76								
Total	40,000	2,200	41,970	2,303								
Miscellaneous:												
Oysters	1,634,500	92,672	1,546,300	89,510					87,607	27,825	89,999	28,450
Crabs, hard	23,400	180	25,500	195					668,645	5,300	675,000	5,350
Crabs, soft	33,900	2,155	39,600	2,360								
Terrapins					19,250	650	21,175	802				
Total	1,691,800	95,007	1,611,400	92,065	19,250	650	21,175	802	756,252	33,125	764,999	33,800
Grand total	6,949,714	154,342	7,552,209	171,416	441,422	11,196	410,730	10,710	2,087,492	88,203	2,139,808	86,238

Statement by counties, apparatus, and species of the yield of the shore fisheries of Virginia—Continued.

Apparatus and species.	Prince William.				Richmond.				Stafford.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Alewives									712, 160	$5, 201	620, 000	$5, 700
Perch									21, 714	850	18, 028	700
Shad									59, 500	1, 850	51, 000	1, 700
Striped bass									7, 600	750	7, 000	700
Sturgeon									150	5		
Other fish									1, 865	75	2, 000	100
Total									802, 989	8, 731	698, 028	8, 900
Pound nets:												
Alewives	62, 000	$610	79, 200	$790	198, 750	$1, 988	150, 000	$1, 500	112, 000	1, 288	140, 000	525
Carp	2, 100	68	1, 980	64					2, 800	140	4, 175	208
Catfish	2, 050	66	2, 710	92	112, 500	3, 375	86, 250	2, 587	9, 800	392	19, 700	591
Eels	1, 500	60	1, 820	70	4, 980	180	4, 265	150	2, 785	140	2, 430	120
Perch	3, 815	158	4, 640	173	29, 812	1, 491	21, 750	1, 088	12, 571	560	19, 214	875
Pike									3, 920	280	4, 820	337
Shad	15, 120	432	14, 400	360	31, 062	887	19, 687	563	4, 900	140	4, 200	105
Squeteague					32, 500	1, 950	24, 375	1, 462				
Striped bass	4, 199	356	4, 910	417	56, 250	5, 625	45, 000	4, 500				
Suckers	520	16	720	21	2, 175	52	1, 845	43	2, 346	72	1, 955	59
Other fish	1, 476	44	1, 840	73	23, 970	702	16, 390	482	3, 695	110	4, 900	147
Total	92, 780	1, 810	112, 220	2, 060	491, 999	16, 250	369, 562	12, 375	154, 817	3, 122	201, 394	2, 967
Gill nets:												
Alewives									440, 000	4, 400	293, 300	3, 520
Perch	3, 500	126	3, 225	113								
Shad	87, 500	2, 500	70, 000	2, 000	152, 250	4, 350	114, 888	3, 282				
Striped bass	4, 450	312	4, 580	321	6, 750	675	7, 150	715				
Other fish	2, 050	62	2, 195	66								
Total	97, 500	3, 000	80, 000	2, 500	159, 000	5, 025	122, 038	3, 997	440, 000	4, 400	293, 300	3, 520
Fyke nets:												
Catfish					7, 250	290	8, 000	320				
Other fish					3, 580	180	4, 000	200				
Total					10, 830	470	12, 000	520				
Miscellaneous:												
Oysters					902, 600	46, 360	831, 600	54, 000				
Frogs	15, 000	1, 875	15, 600	1, 950					600	75	690	86
Total	15, 000	1, 875	15, 600	1, 950	902, 600	46, 360	831, 600	54, 000	600	75	690	86
Grand total	205, 280	6, 685	207, 820	6, 510	1, 564, 429	68, 105	1, 335, 200	70, 892	1, 398, 406	16, 328	1, 193, 412	15, 473

Apparatus and species.	Surry.				Warwick.				Westmoreland.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Alewives											32, 500	$267
Catfish	6, 170	$250	8, 300	$330								
Perch	8, 400	420	7, 000	350								
Striped bass	11, 300	1, 130	8, 765	876							1, 975	158
Suckers	4, 900	118	5, 530	135								
Other fish	16, 980	473	13, 100	381								
Total	47, 750	2, 391	42, 695	2, 072							34, 475	425
Pound nets:												
Alewives					68, 300	$512	53, 300	$400	1, 167, 000	$9, 875	1, 014, 600	10, 000
Bluefish					11, 000	550	8, 000	400	61, 200	3, 060	8, 325	416
Catfish									19, 400	726	32, 200	1, 102
Croakers					2, 700	150	1, 100	66				
Eels									4, 820	250	5, 180	265
Menhaden									76, 800	96	68, 000	85
Perch									11, 420	571	14, 725	736
Shad					16, 800	480	12, 810	366	185, 400	5, 237	165, 665	4, 394
Spanish mackerel					1, 200	75	2, 000	120				
Squeteague					2, 800	168	2, 600	156	64, 300	3, 265	32, 840	1, 642
Striped bass					1, 060	106	1, 300	130	38, 200	3, 098	15, 980	1, 278
Suckers									13, 180	385	15, 260	445
Other fish					8, 400	393	4, 760	238	28, 580	1, 574	30, 835	1, 692
Total					112, 260	2, 434	85, 870	1, 876	1, 670, 300	28, 137	1, 403, 610	22, 055

Statement by counties, apparatus, and species of the yield of the shore fisheries of Virginia—Continued.

Apparatus and species.	Surry.				Warwick.				Westmoreland.			
	1890.		1891.		1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Gill nets:												
Perch	800	$40	500	$25								
Shad	202,765	8,364	152,834	6,375					31,500	$920	25,200	$720
Striped bass	700	70	500	50								
Sturgeon	16,572	765	13,276	536								
Total	220,837	9,239	167,110	6,986					31,500	920	25,200	720
Lines:												
Bluefish					14,795	$739	12,906	$645				
Catfish	286,144	6,975	221,552	5,478								
Croakers					15,037	601	20,310	812				
Spots					13,865	579	12,278	491				
Squeteague					23,807	952	23,031	921				
Other fish					8,037	323	3,531	141				
Total	286,144	6,975	221,552	5,478	75,541	3,194	72,056	3,010				
Miscellaneous:												
Oysters					809,060	28,804	830,893	26,753	368,550	26,436	323,750	27,150
Crabs, hard									70,000	625	68,640	818
Crabs, soft									600	80	1,040	104
Frogs									600	100	660	110
Total					809,060	28,804	830,893	26,753	439,750	27,241	394,090	28,182
Grand total	554,731	18,605	431,357	14,536	996,861	34,432	988,819	31,639	2,141,550	56,298	1,857,375	51,382

Apparatus and species.	York.				Total for State.			
	1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:								
Alewives					2,269,770	$16,802	1,733,846	$15,995
Bluefish					267,260	9,338	243,820	8,481
Carp					2,735	122	3,155	137
Catfish					120,160	3,449	110,995	3,214
Croakers					162,073	6,765	157,315	6,192
Drum					1,200	60	600	30
Eels					2,000	120	1,568	94
Flounders					3,800	114	4,000	120
Kingfish and whiting					49,225	4,607	44,935	4,214
Menhaden					95,000	950	100,000	1,000
Mullet					96,500	2,075	101,700	2,196
Perch					154,232	5,570	135,350	4,880
Sea bass					5,600	316	6,000	360
Shad					518,612	15,676	398,848	13,061
Spots					135,340	5,909	131,219	5,618
Squeteague					639,284	21,047	687,585	18,759
Striped bass					87,746	7,535	80,773	6,888
Sturgeon					8,050	320	6,530	261
Suckers					21,925	628	17,660	505
Other fish					228,925	6,636	210,463	6,069
Total					4,869,437	108,039	4,176,362	98,074
Gill nets:								
Alewives					1,398,600	12,362	1,227,700	11,081
Bluefish					76,725	2,844	81,400	3,069
Catfish					3,800	100	3,300	84
Menhaden					150,000	350	150,000	350
Perch					169,651	6,434	155,682	5,644
Pike					12,638	759	7,595	458
Shad					2,972,006	90,152	2,416,361	73,469
Spanish mackerel					14,250	1,200	14,000	1,170
Mullet					8,000	480	9,000	540
Spots					16,000	645	14,500	550
Squeteague					67,478	2,686	70,740	2,959
Striped bass					108,124	10,146	89,351	8,385
Sturgeon					179,652	6,415	141,796	4,697
Suckers					31,872	894	27,500	793
Other fish					480,291	12,015	448,289	11,368
Total					5,689,087	147,482	4,857,214	124,617

Statement by counties, apparatus, and species of the yield of the shore fisheries of Virginia—Continued.

Apparatus and species.	York.				Total for State.			
	1890.		1891.		1890.		1891.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Pound nets:								
Alewives	75,000	$750	50,000	$500	6,951,178	$62,205	8,033,639	$66,566
Bluefish	20,000	600	15,000	450	970,721	39,028	1,292,398	47,648
Carp					6,000	263	10,215	439
Catfish					369,090	12,128	442,965	14,654
Cobia or crab-eater					194,537	4,798	195,250	4,948
Croaker					262,160	9,120	247,980	8,675
Drum					120,405	2,361	117,340	2,210
Eels					61,105	2,302	62,226	2,298
Flounders					61,000	1,776	61,885	1,700
Kingfish and whiting					95,331	2,843	79,130	2,373
Menhaden					5,742,013	10,624	5,044,634	10,125
Perch					130,737	6,410	143,564	6,930
Pike					3,920	280	4,820	337
Pompano					86,246	8,466	93,700	9,520
Sea bass					1,113	8	1,340	10
Shad	33,250	755	29,165	750	3,732,434	121,664	3,645,467	119,677
Sheepshead					14,405	729	16,200	855
Spanish mackerel					634,543	45,961	725,910	49,586
Spots					105,578	4,104	108,880	4,565
Squeteague	51,000	1,530	39,500	1,185	1,969,368	63,435	1,759,464	58,718
Striped bass					270,164	23,908	256,623	21,824
Sturgeon	10,000	150	10,000	150	629,968	17,779	575,320	16,406
Suckers					35,841	1,034	40,220	1,155
Other fish	10,500	315	10,000	300	880,761	21,564	837,665	20,341
Total	199,750	4,100	153,665	3,335	23,328,618	462,790	23,796,835	471,560
Fyke nets:								
Alewives					10,650	190	8,300	163
Catfish					37,958	1,329	37,532	1,310
Croakers	1,700	80	8,300	390	25,555	973	33,595	1,327
Flounders	11,700	585	10,000	500	17,000	793	15,900	748
Perch					32,019	1,189	30,737	1,145
Shad	29,165	875	24,500	700	43,025	1,400	37,450	1,183
Spots	3,500	175	1,800	90	14,000	490	10,500	351
Squeteague	30,000	1,200	38,000	1,120	76,715	2,819	78,149	2,505
Striped bass	6,000	600	3,350	335	42,695	3,570	36,814	3,042
Suckers					9,444	254	10,984	300
Other fish	17,500	625	11,100	333	34,390	1,100	25,900	771
Total	99,565	4,140	97,050	3,468	343,451	14,107	325,861	12,845
Weirs:								
Alewives					11,500	115	10,000	100
Shad					130	5	116	4
Suckers					18,985	380	20,000	400
Other fish					22,500	588	25,000	625
Total					53,115	1,088	55,116	1,129
Lines:								
Bluefish	12,000	360	10,000	300	155,315	5,935	169,646	6,597
Catfish					408,894	10,827	340,452	9,225
Croakers	15,000	450	17,000	513	672,237	21,687	631,150	20,484
Drum					65,345	1,733	61,562	1,771
Flounders	16,000	480	13,000	390	44,335	1,526	45,510	1,541
Kingfish and whiting	3,000	60	3,000	60	23,500	470	25,500	510
Perch					4,375	262	3,500	210
Sea bass					54,610	1,720	58,970	1,900
Sheepshead					8,370	537	7,671	489
Spots	26,500	795	28,500	855	379,540	14,228	384,078	14,142
Squeteague	46,500	1,395	38,500	1,155	1,313,684	40,578	1,328,311	41,535
Striped bass					20,430	2,043	19,875	1,988
Other fish	10,000	300	11,000	330	102,022	3,236	94,340	2,831
Total	129,000	3,840	121,000	3,603	3,252,657	104,782	3,170,565	103,223
Pots and spears:								
Eels					8,825	597	7,825	515
Miscellaneous:								
Oysters	1,000,721	49,404	1,024,100	44,888	30,866,492	1,876,316	31,627,085	1,897,741
Quahogs	103,920	6,495	103,638	6,480	551,888	36,815	559,278	36,030
Crabs, hard					2,584,794	28,210	2,308,071	32,683
Crabs, soft					440,340	26,054	585,956	29,379
Crawfish							833	75
Frogs					20,232	2,655	21,000	2,754
Terrapins	3,150	2,700	3,150	2,700	52,519	19,066	52,215	18,494
Turtles	5,000	150	5,000	150	203,928	4,279	189,121	3,934
Total	1,112,791	58,749	1,135,888	54,218	34,720,193	1,993,395	35,343,559	2,021,090
Grand total	1,541,106	70,829	1,507,603	64,624	72,265,383	2,832,280	71,733,337	2,833,053

Statistics of oyster-packing and crab-packing trades.—One of the most important branches of the fishing industry of Virginia is the wholesale trade in raw and canned oysters, which is centered at Norfolk. In 1891, 50 firms were engaged in this business. These gave employment to 2,395 persons on shore, to whom $405,000 was paid in wages. The quantity of oysters utilized was 2,617,647 bushels, for which $1,184,694 was paid. The products as sold consisted of 1,667,040 gallons, for which $1,509,542 was received; 225,013 bushels disposed of in the shell, bringing $269,208; and 396,626 cans of oysters, having a market value of $56,610. The details of this branch in 1890 and 1891 are shown in the table:

Summary of the oyster-packing trade of Virginia.

Designation.	1890.	1891.
Number of firms	39	50
Number of persons employed	1,902	2,395
Value of property	$310,500	$355,000
Cash capital	$268,300	$295,000
Wages paid	$337,196	$405,306
Oysters handled ... bushels	2,135,078	2,617,647
Value	$971,847	$1,184,694
Sold opened ... gallons	1,348,600	1,667,040
Value	$1,208,798	$1,509,542
Sold in the shell ... bushels	228,753	225,013
Value	$290,848	$269,208
Canned ... quart cans	374,026	396,626
Value	$52,947	$56,610

The business of extracting the meat of cooked hard crabs and shipping it in buckets is engaged in by a few firms at Norfolk and Hampton. In 1891 three firms employed 317 persons, to whom $15,367 was paid in wages. Over 10,000 barrels of hard crabs, equivalent to 3,352,000 crabs, having a value of about $12,500, were utilized in preparing 216,480 pounds of meat, worth $40,776. A summary of this branch of the fishing industry for 1890 and 1891 is given in the following table:

Summary of the crab-packing industry of Virginia.

Designation.	1890.	1891.
Number of firms	2	3
Number of persons employed:		
Male, white	17	22
Male, colored	25	40
Female, colored	190	255
Total	232	317
Value of property	$24,000	$24,000
Cash capital	$14,000	$17,000
Wages paid	$19,250	$15,367
Number of barrels of crabs used	10,363	10,158
Cost	$9,090	$12,461
Pounds of crab meat prepared	252,624	216,480
Value	$50,637	$40,776

STATISTICS OF SPECIAL FISHERIES.

THE SHAD FISHERIES.

The shad is the most valuable fish taken in the Middle Atlantic States and is second only to the oyster among all the fishery products of the region. In every State it is the most important fish taken. In being the fish which has been most extensively propagated in the United States, the shad has additional interest, and much of the present importance of the shad fishery is undoubtedly due to the effects of the fish-cultural operations of the General Government and the States.

The following tables show the full extent of the shad fishery in each of the States of this section. In the preceding tables only the quantity of shad taken and the value of the catch are given. In the present statistics, however, the number of shad fishermen and the quantity and value of the shad apparatus are exhibited. The figures relate to each State and the entire region, and apply to the year 1891.

The first table shows the number of persons in each State who fished especially for shad and used the forms of apparatus indicated. While it is probable that slight duplication occurs in some localities in which fishermen may operate more than one kind of apparatus for shad, the extent of this practice is very limited.

The number of shad fishermen was 11,592, of whom the greatest number, 3,835, were in Maryland, and the smallest, 658, in Delaware. More than half the men employed gill nets, and about a fourth used seines, these two forms of apparatus being prominent in every State. A few persons fished shad fykes in New Jersey, and a small number used dip nets in Pennsylvania. Pound-net fishermen, who were found only in Maryland and Virginia, rank after the gill-net and seine men in number.

The value of the apparatus, boats, and other property devoted to the shad fishery of the Middle Atlantic States was $1,018,466. The principal items in this sum were gill nets, of which 23,197, valued at $325,767, were fished. The 5,858 boats employed in the various branches of the fishery had a value of $314,867. The number of pound nets set was 1,333, with a value of $193,390. Next in value were the 564 seines, $100,918. Two hundred and twenty four fyke nets worth $4,050, and 170 dip nets with a value of $494, complete the list of apparatus. Reels and other shore property connected with the fishery had a value of $78,980. The largest investment was in Maryland, which had the most seines and gill nets. Virginia ranked next in aggregate investment, and took precedence in the number of pound nets.

Apparatus used specially for shad took 8,247,191 fish, for which the fishermen received $1,187,969, or an average of 14.4 cents per fish. The number of shad taken incidentally in apparatus fished primarily for other fish was 190,955, worth $28,620. Two-thirds of the shad were caught with gill nets. Pound nets ranked next, and then seines. The catch of the other apparatus was relatively insignificant. Gill nets as means of capture were most important in New Jersey, seines in Pennsylvania, pound nets in Virginia.

Persons engaged in the shad fisheries of the Middle Atlantic States.

How engaged.	New York.	New Jersey.	Pennsylvania.	Delaware.	Maryland.	Virginia.	Total.
Seine fishery	253	351	719	261	1,255	93	2,932
Gill-net fishery	988	1,724	350	397	2,102	1,585	7,146
Pound-net fishery					478	894	1,372
Fyke-net fishery		23					23
Dip-net fishery			119				119
Total	1,241	2,098	1,188	658	3,835	2,572	11,592

Apparatus, boats, and shore property employed in the shad fisheries of the Middle Atlantic States.

Designation.	New York.		New Jersey.		Pennsylvania.	
	No.	Value.	No.	Value.	No.	Value.
Seines	56	$8,395	45	$14,965	146	$18,745
Boats	90	5,190	98	7,810	280	13,076
Shore property	....	3,668	....	4,159	....	5,362
Gill nets	2,930	58,770	3,306	101,280	184	18,770
Boats	701	38,775	943	96,150	189	11,165
Shore property	....	6,016	....	6,345	....	....
Fyke nets	....	....	224	4,050	....	....
Boats	....	....	17	1,550	....	....
Shore property	....	....	....	900	....	....
Dip nets	....	....	....	....	170	494
Boats	....	....	....	....	97	1,064
Total	....	120,814	....	237,209	....	68,676

Designation.	Delaware.		Maryland.		Virginia.		Total.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Seines	76	$3,653	214	$36,650	27	$18,510	564	$100,918
Boats	88	1,815	261	14,989	42	1,415	859	44,295
Shore property	....	350	....	9,340	....	2,520	....	25,399
Gill nets	236	16,833	10,254	90,650	6,287	39,464	23,197	325,767
Boats	201	8,826	1,112	63,987	874	12,060	4,020	230,963
Shore property	....	450	....	6,120	....	7,920	....	26,851
Pound nets	....	....	625	59,510	708	133,880	1,333	193,390
Boats	....	....	251	11,310	614	25,685	865	36,995
Shore property	....	....	....	3,880	....	21,950	....	25,830
Fyke nets	....	....	....	....	....	....	224	4,050
Boats	....	....	....	....	....	....	17	1,550
Shore property	....	....	....	....	....	....	....	900
Dip nets	....	....	....	....	....	....	170	494
Boats	....	....	....	....	....	....	97	1,064
Total	....	31,927	....	296,436	....	263,404	....	1,018,466

Yield of shad in the Middle Atlantic States.

Apparatus.	New York.		New Jersey.		Pennsylvania.	
	Number.	Value.	Number.	Value.	Number.	Value.
Special apparatus:						
Seines	82,622	$16,668	211,223	$43,733	429,615	$81,772
Gill nets	660,923	139,932	2,600,100	385,889	305,802	44,448
Fyke nets	....	....	32,500	5,261	....	....
Dip nets	....	....	....	....	8,118	2,029
Total	743,545	156,600	2,843,823	434,883	743,535	128,249
Other apparatus:						
Seines	412	80	9,107	1,719	....	....
Pound nets	10,163	2,456	26,662	6,026	....	....
Fyke nets	8,826	2,073	4,490	810	120	25
Total	19,401	4,609	40,259	8,555	120	25
Grand total	762,946	161,209	2,884,082	443,438	743,655	128,274

Apparatus.	Delaware.		Maryland.		Virginia.		Total.	
	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.
Special apparatus:								
Seines	32,964	$7,140	369,072	$47,280	117,946	$12,994	1,243,442	$209,587
Gill nets	394,952	57,418	1,018,263	121,896	708,240	73,082	5,688,280	822,665
Pound nets	....	....	254,832	31,896	1,020,019	116,531	1,274,851	148,427
Fyke nets	....	....	....	....	....	....	32,500	5,261
Dip nets	....	....	....	....	....	....	8,118	2,029
Total	427,916	64,558	1,642,167	201,072	1,846,205	202,607	8,247,191	1,187,969
Other apparatus:								
Seines	....	....	28,526	4,213	705	67	38,750	6,079
Gill nets	....	....	16,160	1,853	4,436	387	20,596	2,240
Pound nets	566	80	19,678	2,652	35,345	3,146	92,414	14,360
Fyke nets	426	61	8,371	1,023	12,843	1,183	35,076	5,175
Minor apparatus	....	....	4,080	762	39	4	4,119	766
Total	992	141	76,815	10,503	53,368	4,787	190,955	28,620
Grand total	428,908	64,699	1,718,982	211,575	1,899,573	207,394	8,438,146	1,216,589

The average price of the shad varies considerably with the apparatus and the State in which the fish are taken. Considering the aggregate catch, the fish obtained with seines have a higher valuation than those secured by other means, and the shad taken in New York bring the best price.

The average prices received for shad in 1891, specified by States and by apparatus in which taken

States.	Gill nets.	Pound nets.	Seines.	Fyke nets.	All other nets.	Total.
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents*	*Cents.*
New York	21.2	24.2	20.2	23.5	....	21.1
New Jersey	14.8	22.6	20.6	16.4	....	15.4
Pennsylvania	14.5	....	19.0	20.8	25.0	17.2
Delaware	14.5	14.1	21.7	14.3	....	15.1
Maryland	12.0	12.6	12.9	12.2	18.7	12.3
Virginia	10.3	11.3	14.1	9.2	10.3	10.9
Total	14.4	11.9	16.8	15.4	22.8	14.4

THE GENERAL MOLLUSCAN FISHERIES.

The taking of economic mollusks is the most important branch of the fishing industry of the Middle Atlantic States. More persons are engaged and more capital is invested in the shellfish fisheries of the region than in all other branches combined, and the value of these products is about four-fifths that of the entire fishery output. The mollusks which have commercial importance are oysters, mussels, scallops, quahogs or hard clams, soft clams, and several species of univalve shells locally known as "jingles" and "quarter-decks," which are employed in oyster planting. The appended tables relating to 1891 indicate the various phases of the business.

Of 49,653 persons engaged in the fisheries for mollusks, 21,878 were in Maryland and 16,352 in Virginia, in addition to the large number of employés connected with the oyster-shucking and oyster-canning trades, which are not now under consideration.

The capital invested in the molluscan fisheries was $6,154,329, of which $2,562,178 is credited to Maryland, and over $1,000,000 to each of the States of Virginia, New York, and New Jersey. Of the 3,008 vessels employed in taking shellfish, 1,223 were in Maryland, 707 in Virginia, 516 in New York, and 496 in New Jersey. The transporting fleet numbered 723, of which 611 were in Maryland and Virginia. Over 21,500 boats were employed, of which 6,974 were in Virginia and 6,692 in Maryland.

The value of the mollusks taken was $13,690,810. Of this amount Maryland had $5,304,092, New York $3,570,211, Virginia $2,560,378, New Jersey $2,059,481, Pennsylvania $124,420, and Delaware $72,228. The quantity of products taken was 23,112,640 bushels, of which oysters constituted 21,346,107 bushels, valued at $12,402,925, and round clams or quahogs 1,088,438 bushels, valued at $1,068,904. Oysters are taken by citizens of every State of this region, and quahogs in every State but Pennsylvania, while soft clams and mussels have commercial importance only in New York and New Jersey, and scallops and shells only in New York.

Persons engaged in the molluscan fisheries of the Middle Atlantic States.

States.	Fishermen.	Transporters.	Total.
New York	5,970	101	6,071
New Jersey	4,677	134	4,811
Pennsylvania	233	....	233
Delaware	265	43	308
Maryland	20,434	1,444	21,878
Virginia	15,642	710	16,352
Total	47,221	2,432	49,653

Apparatus, vessels, boats, and shore property employed in the molluscan fisheries of the Middle Atlantic States.

States.	Value of apparatus.	Vessels fishing.			Vessels transporting.			Boats (shore).		Floats and shore property.	Total investment.
		No.	Value.	Value of outfit.	No.	Value.	Value of outfit.	No.	Value.		
New York	$119,912	516	$391,270	$55,682	41	$44,100	$5,710	4,819	$318,985	$144,500	$1,080,159
New Jersey	62,949	496	479,070	106,545	55	70,250	7,636	2,918	185,292	166,380	1,078,122
Pennsylvania	5,035	41	73,650	11,525							90,210
Delaware	2,522	25	21,525	3,390	16	13,250	1,975	112	1,746	2,860	47,268
Maryland	192,626	1,223	877,505	325,658	399	569,000	59,190	6,692	516,849	21,350	2,562,178
Virginia	75,511	707	385,160	132,875	212	242,895	29,421	6,974	412,030	18,500	1,296,392
Total	458,555	3,008	2,228,180	635,675	723	939,495	103,932	21,515	1,434,902	353,590	6,154,329

Products of the molluscan fisheries of the Middle Atlantic States.

Species.	New York.		New Jersey.		Pennsylvania.	
	Bushels.	Value.	Bushels.	Value.	Bushels.	Value.
Oysters	2,611,062	$2,748,509	2,302,081	$1,639,648	169,100	$124,420
Quahogs or hard clams	565,565	650,621	431,753	371,933		
Soft clams or long clams	150,550	105,891	82,700	47,700		
Mussels	2,100	900	600	200		
Scallops	69,565	48,340				
Shells	372,580	15,950				
Total	3,771,422	3,570,211	2,817,134	2,059,481	169,100	124,420

Species.	Delaware.		Maryland.		Virginia.		Total.	
	Bushels.	Value.	Bushels.	Value.	Bushels.	Value.	Bushels.	Value.
Oysters	156,720	$70,134	9,945,058	$5,295,866	6,162,086	$2,524,348	21,346,107	$12,402,925
Quahogs or hard clams	2,740	2,094	18,470	8,226	69,910	36,030	1,088,438	1,068,904
Soft clams or long clams							233,250	153,591
Mussels							2,700	1,100
Scallops							69,565	48,340
Shells							372,580	15,950
Total	159,460	72,228	9,963,528	5,304,092	6,231,996	2,560,378	23,112,640	13,690,810

THE OYSTER INDUSTRY.

The following series of tables illustrates the extent of the most important branch of the fishing industry of the Middle Atlantic region. In the consideration of the general molluscan fisheries, the oyster fishery was included, but no separate figures for the persons and for the vessels, boats, and apparatus were given, and the shore industry connected with the fishery was not shown.

It appears from the first table that 60,631 persons were engaged in this industry, of whom 13,192 were vessel fishermen, 29,479 boat fishermen, 2,418 transporters, and 15,542 shore employés. In each of these items Maryland held the first rank, and the total for the State was 32,104.

The capital invested in the oyster industry was $13,047,094, of which more than half, or $6,697,302, is to be credited to Maryland. The 2,839 fishing vessels employed were valued, with their outfits and apparatus, at $3,018,003, and the 723 transporting vessels had a value of $1,039,802. The value of the 17,830 boats used in the shore fisheries was $1,222,356, and the apparatus employed in connection with the boat fishing had a value of $189,118.

The output of the oyster fishery was 21,346,107 bushels, valued at $12,402,925. The yield in the vessel fishery was 9,468,156 bushels, valued at $5,614,368, and in the shore fishery 11,877,951 bushels, having a value of $6,788,557. The shore fishery was more important than the vessel fishery in New York, Maryland, and Virginia. In the

value of its oyster fishery New York ranks next to Maryland, although the quantity of oysters taken is less than half that in Virginia.

Persons engaged in the oyster industry of the Middle Atlantic States.

States.	In vessel fishery.	In shore fishery.	On transporting vessels.	On shore, in markets, etc.	Total.
New York	1,126	2,458	96	1,145	4,825
New Jersey	1,647	1,942	134	329	4,052
Pennsylvania	233			172	405
Delaware	103	153	43	353	652
Maryland	6,862	12,505	1,444	11,293	32,104
Virginia	3,221	12,421	701	2,250	18,593
Total	13,192	29,479	2,418	15,542	60,631

Vessels, boats, apparatus, shore property, and cash capital employed in the oyster industry of the Middle Atlantic States.

Designation.	New York.		New Jersey.		Pennsylvania.	
	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	441	$357,457	402	$430,995	41	$73,650
Tonnage	4,556		6,540		1,007	
Outfit		84,635		95,170		11,525
Dredges	1,465	34,380	1,520	38,930	164	5,035
Tongs and rakes	1,420	6,690	13	60		
Vessels transporting	41	44,100	55	70,250		
Tonnage	796		1,033			
Outfit		5,710		7,636		
Boats fishing	2,771	206,505	2,123	145,599		
Dredges	1,310	13,150	28	675		
Rakes	1,260	9,917	40	160		
Tongs	3,937	24,266	2,430	11,472		
Shore property and floats		674,550		226,380		284,500
Cash capital		828,000		467,850		183,750
Total		2,289,360		1,495,177		558,460

Designation.	Delaware.		Maryland.		Virginia.		Total.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	25	$21,525	1,223	$868,505	707	$385,160	2,839	$2,137,292
Tonnage	304		20,981		8,155		41,543	
Outfit		3,390		325,658		132,775		653,153
Dredges	100	2,110	2,419	111,374	460	18,210	6,128	210,039
Tongs and rakes			494	4,287	1,367	6,482	3,294	17,519
Vessels transporting	16	13,250	399	569,000	212	239,895	723	936,495
Tonnage	224		13,111		5,114		20,278	
Outfit		1,975		59,190		28,796		103,307
Boats fishing	103	1,586	5,859	456,636	6,974	412,030	17,830	1,222,356
Dredges			1,726	8,363	99	4,045	3.163	26,233
Rakes							1,300	10,077
Tongs	103	412	12,367	69,814	9,880	46,844	28,717	152,808
Shore property and floats		19,880		2,282,525		356,930		3,844,765
Cash capital		18,500		1,941,950		293,000		3,733,050
Total		82,628		6,697,302		1,924,167		13,047,094

Yield of the oyster fishery of the Middle Atlantic States.

States.	Vessel fishery.		Shore fishery.		Total.	
	Bushels.	Value.	Bushels.	Value.	Bushels.	Value.
New York	1,282,252	$1,185,549	1,328,810	$1,562,960	2,611,062	$2,748,509
New Jersey	1,499,759	1,018,302	802,322	621,346	2,302,081	1,639,648
Pennsylvania	169,100	124,420			169,100	124,420
Delaware	59,000	43,650	97,720	26,484	156,720	70,134
Maryland	4,814,114	2,615,840	5,130,944	2,680,026	9,945,058	5,295,866
Virginia	1,643,931	626,607	4,518,155	1,897,741	6,162,086	2,524,348
Total	9,468,156	5,614,368	11,877,951	6,788,557	21,346,107	12,402,925

THE LOBSTER FISHERY.

Although the taking of lobsters is not one of the prominent branches of the fishing industry of this region, it possesses special interest in that the lobster here reaches the southern limits of its range as an economic product, Delaware being the southernmost State in which it is obtained.

Eighty-four persons in the three most northern coast States of the region were engaged in this fishery in 1891; of these, 55 were in New York, 27 in New Jersey, and 2 in Delaware. The pots used numbered 3,235 and had a value of $4,987. The catch consisted of 338,957 pounds, for which the fishermen received $28,528. The yield was largest in New Jersey, but the value of the output was greatest in New York.

Extent of the lobster fishery of the Middle Atlantic States.

Designation.	New York.		New Jersey.		Delaware.		Total.	
	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.
Persons employed	55		27		2		84	
Apparatus, vessels, and boats:								
Pots	2,240	$3,469	955	$1,418	40	$100	3,235	$4,987
Vessels	2	8,020	1	1,100			3	9,120
Outfit		1,860		375				2,235
Boats	34	1,140	12	870	1	40	47	2,050
Total		14,489		3,763		140		18,392
Products:								
Lobsters ....pounds..	165,093	15,655	165,664	12,463	8,200	410	338,957	28,528

THE SEINE FISHERIES.

The seine is one of the most generally used forms of apparatus employed in the fisheries of the region, and in some States and some fisheries is more prominent than any other means of capture. The output of the seines is larger and more valuable than that of any other apparatus used in taking fish, considering the entire region. The extent of the fisheries thus prosecuted is shown in the following tabulations.

The number of persons engaged in seine fishing in the Middle Atlantic States in 1891 was 8,157; the number of seines used was 1,808, valued at $278,230; the number of vessels engaged was 80, valued at $535,000; the boats used numbered 2,187 and were worth $131,425; the value of the shore property was $79,557; the total investment was $1,113,210; the quantity of products taken was 278,159,491 pounds, for which $1,427,790 was received.

The most valuable fish taken with seines is the menhaden; this is also secured in larger quantities than any other fish. The catch in 1891 was 245,861,226 pounds, valued at $580,677. Almost the entire yield is taken with vessels employing purse seines. The shad ranks next in value, although the alewives are obtained in larger quantities. The production was 4,624,645 pounds, having a value of $215,666. Of alewives, 16,622,834 pounds were taken, worth $136,411; of squeteague, 3,176,675 pounds, valued at $99,932; and of striped bass 893,065 pounds, with a value of $90,087.

Of the prominent fish taken with seines, the menhaden is most valuable in New York, the squeteague and the yellow perch in New Jersey, the shad in Pennsylvania, the alewives, the white perch, and the striped bass in Maryland, and the spot in Virginia.

Persons, apparatus, vessels, boats, and shore property employed in the seine fisheries of the Middle Atlantic States.

States.	No. of persons.	Seines.		Vessels.			Boats.		Shore property.	Total investment.
		No.	Value.	No.	Value.	Value of outfit.	No.	Value.		
New York	1,410	327	$75,640	26	$245,000	$47,655	385	$27,980	$4,886	$401,161
New Jersey	1,459	372	38,022	11	40,050	10.987	423	17,476	9,340	115,875
Pennsylvania	731	151	19,405	......	....	....	284	13,155	5,357	37,917
Delaware	694	203	10,263	......	....	....	217	4,610	2,230	17,103
Maryland	2,487	536	76,780	13	20,500	4,010	596	58,764	26,644	186,698
Virginia	1,376	219	58,120	30	229,450	26,346	282	9,440	31,100	354,456
Total	8,157	1,808	278,430	80	535,000	88,998	2,187	131,425	79,557	1,113,210

Products of the seine fisheries of the Middle Atlantic States.

Species.	New York.		New Jersey.		Pennsylvania.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives	1,136,597	$14,615	1,783,470	$12,128	2,104,700	$10,948
Bluefish	1,230,495	50,228	29,900	1,567	....	....
Catfish	17,025	996	88,609	4,824	31,483	1,754
Drum	....	....	95,240	203	....	....
Eels	10,748	725	72,200	4,518	....	....
Flounders	15,650	750	95,500	4,260	....	....
Kingfish	124,318	7,759	17,400	1,142	....	....
Menhaden	99,057,690	288,123	16,441,436	42,955	....	....
Mullet	160,060	7,878	88,350	4,902	....	....
Perch	41,808	2,901	573,773	30,921	6,495	368
Pike	....	....	17,585	1,738	975	97
Sea bass	248,614	12,715	8,400	458	....	....
Shad	332,085	16,748	788,175	45,452	1,575,309	81,772
Sheepshead	....	....	6,000	955	....	....
Spanish mackerel	57,604	4,031	....	....	....	....
Spots and croakers	....	....	11,200	521	....	....
Squeteague	401,030	19,803	775,600	36,989	....	....
Striped bass	95,503	8,406	180,658	27,276	5,280	532
Sturgeon	....	....	....	....	....	....
Suckers	....	....	10,730	417	23,100	1,137
Tautog	1,800	110	1,900	136	....	....
Tomcod or frostfish	179,150	7,166	....	....	....	....
Other fish	78,197	2,997	38,040	1,715	69,905	3,600
Total	103,188,374	445,951	21,124,166	223,077	3,817,247	100,208

Species.	Delaware.		Maryland.		Virginia.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives	515,640	$7,178	9,356,231	$75,547	1,733,846	$15,995	16,630,484	$136,411
Bluefish	....	....	110,519	5,026	253,820	8,781	1,624,734	65,602
Catfish	21,000	1,135	373,257	13,194	110,995	3,214	642,369	25,117
Drum	30,000	380	....	....	600	30	125,840	613
Eels	....	....	40,176	1,685	1,568	94	124,692	7,022
Flounders	5,000	168	....	....	4,000	120	120,150	5,298
Kingfish	....	....	....	....	44,935	4,214	186,653	13,115
Menhaden	8,000	40	29,568,400	62,511	100,785,700	187,048	245,861,226	580,677
Mullet	3,800	114	44,300	1,586	101,700	2,196	398,210	16,676
Perch	143,780	8,220	917,667	39,015	135,350	4,880	1,818,873	86,305
Pike	7,800	558	189,677	11,632	....	....	216,037	14,025
Sea bass	....	....	110,000	4,400	6,000	360	373,014	17,933
Shad	115,374	7,140	1,414,854	51,493	398,848	13,061	4,624,645	215,666
Sheepshead	....	....	....	....	....	....	6,000	955
Spanish mackerel	....	....	4,267	640	....	....	61,871	4,671
Spots and croakers	13,900	811	68,075	2,997	288,534	11,810	381,709	16,139
Squeteague	1,114,900	16,188	197,560	8,193	687,585	18,759	3,176,675	99,932
Striped bass	44,850	5,958	486,001	41,027	80,773	6,888	893,065	90,087
Sturgeon	....	....	6,940	317	6,530	261	13,470	578
Suckers	5,200	266	81,100	2,096	17,660	505	137,790	4,421
Tautog	....	....	....	....	....	....	3,700	246
Tomcod or frostfish	....	....	....	....	....	....	179,150	7,166
Other fish	....	....	159,374	4,617	213,618	6,206	559,134	19,135
Total	2,029,244	48,156	43,128,398	325,976	104,872,062	284,422	278,159,491	1,427,790

THE GILL-NET FISHERIES.

In 1891 the gill-net fisheries of this region gave employment to 9,134 persons, a larger number than was found in any other fishery, with the exception of the oyster. Of these, 2,368 were in New Jersey, 2,235 in Maryland, 1,664 in New York, 1,564 in Virginia, 906 in Delaware, and 397 in Pennsylvania.

Of the total amount of capital devoted to this fishery, viz, $820,182, $419,722 represented the 30,158 gill nets employed; $328,282 the 5,079 boats used, and $72,178 the shore property required for the proper prosecution of the fishery. Maryland had a larger number of nets than any other State; but the value of the nets was greatest in New Jersey, and the aggregate investment in the latter State was also greatest.

The yield of the gill-net fisheries was 33,682,198 pounds, valued at $1,159,031. The fishermen of New Jersey took 10,586,442 pounds and received $435,908 for their catch. New York is credited with an output of 4,953,280 pounds, valued at $222,014. Maryland ranks third, with 8,571,287 pounds, for which $217,088 was received. Virginia fishermen took 4,857,214 pounds, having a value of $124,617.

The preeminent fish in the gill-net fishery is the shad; the catch was 20,515,161 pounds, worth $824,936. Bluefish, squeteague, striped bass, sturgeon, and alewives are the next important species.

Persons, apparatus, boats, and shore property employed in the gill-net fisheries of the Middle Atlantic States.

States.	No. of persons.	Gill nets.		Boats.		Shore property.	Total investment.
		No.	Value.	No.	Value.		
New York	1, 664	6, 402	$88, 450	995	$59, 715	$15, 566	$163, 731
New Jersey	2, 368	3, 983	129, 832	1, 261	143, 014	44, 742	317, 588
Pennsylvania	397	209	21, 450	211	12, 705	480	34, 635
Delaware	906	1, 586	33, 946	471	22, 132	1, 250	57, 328
Maryland	2, 235	11, 999	100, 014	1, 194	74, 571	2, 280	176, 865
Virginia	1, 564	5, 979	46, 030	947	16, 145	7, 860	70, 035
Total	9, 134	30, 158	419, 722	5, 079	328, 282	72, 178	820, 182

Products of the gill-net fisheries of the Middle Atlantic States.

Species.	New York.		New Jersey.		Pennsylvania.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives	987, 440	$7, 780	13, 700	$160	222, 000	$2, 475
Bluefish	709, 650	37, 467	254, 600	11, 767		
Cod			45, 800	1, 603		
Menhaden			214, 763	1, 507		
Mullet						
Perch	17, 150	1, 527	33, 500	3, 162		
Pike			1, 900	166		
Sea bass	75, 041	6, 617				
Shad	2, 643, 695	139, 932	9, 196, 938	385, 889	1, 088, 050	44, 448
Spanish mackerel			35, 410	5, 710		
Spots and croakers			1, 700	81		
Squeteague	438, 517	23, 153	210, 800	8, 407		
Striped bass	14, 200	1, 701	49, 371	6, 618		
Sturgeon	7, 560	302	428, 700	9, 562	52, 700	640
Suckers	8, 670	650	500	15		
Other fish	51, 357	2, 885	98, 760	1, 261	7, 800	390
Total	4, 953, 280	222, 014	10, 586, 442	435, 908	1, 370, 550	47, 953

Products of the gill-net fisheries of the Middle Atlantic States—Continued.

Species.	Delaware.		Maryland.		Virginia.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives	335, 100	$5, 149	2, 806, 900	$15, 723	1, 227, 700	$11, 081	5, 592, 840	$42, 368
Bluefish			219, 020	9, 782	81, 400	3, 069	1, 264, 670	62, 085
Cod							45, 800	1, 603
Menhaden	59, 000	380	451, 000	1, 084	150, 000	350	874, 763	3, 321
Mullet	35, 100	1, 011	50, 640	1, 250	9, 000	540	94, 740	2, 801
Perch	93, 515	6, 902	424, 804	19, 573	155, 682	5, 644	724, 651	36, 808
Pike	16, 650	960	150, 893	9, 398	7, 595	458	177, 038	10, 982
Sea bass							75, 041	6, 617
Shad	1, 382, 330	57, 418	3, 787, 787	123, 780	2, 416, 361	73, 469	20, 515, 161	824, 936
Spanish mackerel			10, 370	1, 105	14, 000	1, 170	59, 780	7, 985
Spots and croakers	28, 560	1, 469	11, 240	499	14, 500	550	56 000	2, 599
Squeteague	23, 530	706	85, 510	2, 871	70, 740	2, 959	829, 097	38, 096
Striped bass	45, 070	6, 152	339, 276	24, 881	89, 351	8,385	537, 268	47, 737
Sturgeon	1, 304, 800	30, 448	50, 300	1, 390	141, 796	4, 697	1, 985, 856	47, 039
Suckers	5, 650	227	20, 800	520	27, 500	793	63, 120	2, 205
Other fish	14, 120	629	162, 747	5, 232	451, 589	11, 452	786, 373	21, 849
Total	3, 343, 425	111, 451	8, 571, 287	217, 088	4, 857, 214	124, 617	33, 682, 198	1, 159, 031

THE POUND-NET FISHERIES.

Pound nets are operated in all the Middle Atlantic States except Pennsylvania. The fishery is especially important in the Chesapeake region on account of the number of nets used and the large quantities of fish taken, and in New York and New Jersey because of the opposition encountered. The extent of the fisheries with pound nets proper and with the closely related traps and weirs is indicated in the following tables, which relate to the year 1891.

Of the 2,512 persons engaged in these fisheries, 1,304 were in Virginia, 691 in Maryland, 261 in New Jersey, 244 in New York, and 12 in Delaware.

While Maryland had the largest number of nets, many of them were of small size. The 1,005 operated were valued at only $71,778, while 941 in Virginia were worth $166,990. The 263 nets shown for New York include 90 trap nets operated by vessels—a feature which is not observed in any other State. The value of the 1,557 boats used was $72,908. Of the total investment of $550,470, Virginia is credited with $232,446, New York with $127,620, and Maryland with $102,293.

These nets took 50,657,120 pounds of fish, valued at $888,083. The fishermen of Virginia caught 23,851,951 pounds, for which they received $472,689, thus obtaining nearly half the quantity and more than half the value of the pound-net yield. In Maryland 8,875,190 pounds were taken, worth $165,423. The output in New York was larger, viz, 9,909,828 pounds, but the value was only $123,834. The New Jersey fishermen took 7,992,260 pounds, for which they received $125,100. The Delaware pound nets caught 27,891 pounds, worth $1,037. In some of the States small numbers of lobster, king crabs, and squid were also taken in the pound nets, but are not shown in the table.

Considering the entire region, the most prominent fish taken in the pound-net fisheries is the squeteague or weakfish. The quantity taken was 6,433,104 pounds, valued at $180,995. Shad ranked next in value; of this fish, 4,756,243 pounds were taken, for which $162,760 were received. Alewives to the quantity of 13,035,391 pounds were obtained; these had a value of $105,533. The squeteague was the most important fish in New York and New Jersey, the alewives were most prominent in Maryland, and the shad had first rank in Virginia.

Persons, apparatus, vessels, boats, and shore property employed in the pound-net, trap-net, and weir fisheries of the Middle Atlantic States.

States.	No. of persons.	Pound nets, trap nets, and weirs.		Vessels.		Value of outfit.	Boats.		Shore property.	Total investment.
		No.	Value.	No.	Value.		No.	Value.		
New York	244	263	$71, 340	21	$17, 600	$15, 090	136	$8, 620	$14, 970	$127, 620
New Jersey	261	185	55, 370	......	....	....	71	8, 382	23, 939	87, 691
Delaware	12	20	305	......	....	....	10	115	....	420
Maryland	691	1, 005	71, 778	......	....	....	456	19, 815	10, 700	102, 293
Virginia	1, 304	941	166, 990	......	....	....	884	35, 976	29, 480	232, 446
Total	2, 512	2, 414	365, 783	21	17, 600	15, 090	1, 557	72, 908	79, 089	550, 470

Products of the pound-net, trap-net, and weir fisheries of the Middle Atlantic States.

Species.	New York.		New Jersey.		Delaware.		Maryland.		Virginia.		Total.	
	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.	Lbs.	Value.
Alewives	38,203	$727	45,300	$681	13,020	$85	4,895,229	$37,374	8,043,639	$66,666	13,035,391	$105,533
Bluefish	166,050	6,845	189,979	8,547	......	......	109,215	5,033	1,292,398	47,648	1,757,642	68,073
Bonito	1,750	150	54,733	2,141	......	......	......	......	......	......	56,483	2,291
Butter-fish	794,046	12,340	206,052	5,601	......	......	......	......	......	......	1,000,098	17,941
Catfish	......	......	......	......	3,340	168	306,546	9,712	442,965	14,654	752,851	24,534
Cobia or crab-eater	......	......	......	......	......	......	......	......	195,250	4,948	195,250	4,948
Drum	......	......	......	......	......	......	......	......	117,340	2,210	117,340	2,210
Eels	75,014	3,500	1,200	84	......	......	97,430	3,732	62,226	2,298	235,870	9,614
Flounders	221,698	4,934	196,867	4,645	......	......	21,500	650	61,885	1,700	501,950	11,929
Kingfish or whiting	16,328	2,076	2,247	278	......	......	......	......	79,130	2,373	97,705	4,727
Mackerel	......	......	25,017	2,304	......	......	......	......	......	......	25,017	2,304
Menhaden	5,154,424	6,672	3,985,176	12,459	......	......	932,720	1,712	5,044,634	10,125	15,116,954	30,968
Perch	......	......	1,300	49	6,290	334	673,898	25,925	143,564	6,930	825,052	33,238
Pike	......	......	......	......	500	30	115,110	6,932	4,820	337	120,430	7,299
Pompano	......	......	......	......	......	......	......	......	93,700	9,520	93,700	9,520
Scup	310,358	6,206	12,982	311	......	......	......	......	......	......	323,340	6,517
Sea bass	140,489	7,093	29,188	946	......	......	......	......	1,340	10	171,017	8,049
Shad	36,386	2,456	93,318	6,026	1,491	80	979,465	34,517	3,645,583	119,681	4,756,243	162,760
Sheepshead	19,523	3,500	17,240	2,629	......	......	......	......	16,200	855	52,963	6,984
Skates	101,897	2,022	......	......	......	......	......	......	......	......	101,897	2,022
Spanish mack'l	17,232	3,224	36,981	4,885	......	......	30,200	3,624	725,910	49,586	810,323	61,319
Spots and croakers	17,501	700	1,080	21	......	......	91,870	4,604	356,860	13,240	467,311	18,565
Squeteague	1,579,006	48,107	3,012,299	70,336	......	......	82,335	3,834	1,759,464	58,718	6,433,104	180,995
Striped bass	49,468	6,100	17,400	1,278	1,750	265	270,883	19,651	256,623	21,824	596,124	49,118
Sturgeon	21,001	559	23,930	1,657	......	......	15,205	636	575,320	16,406	635,456	18,658
Suckers	......	......	......	......	......	......	122,750	3,207	60,220	1,555	182,970	4,762
Tautog	73,942	2,983	12,437	261	......	......	......	......	......	......	86,379	3,244
Refuse fish	286,829	716	......	......	......	......	......	......	......	......	286,829	716
Other fish	788,683	2,924	27,534	561	1,500	75	130,834	4,280	872,880	21,405	1,821,431	29,245
Total	9,909,828	123,834	7,992,260	125,100	27,891	1,037	8,875,190	16[illegible],423	23,851,951	472,689	50,657,120	888,083

THE FYKE-NET AND POT FISHERIES.

Fyke nets and pots are very extensively used in this region and contribute very materially to the income of a large class of semiprofessional fishermen as well as constituting a part of the fishing outfit employed by regular fishermen who operate more important kinds of apparatus. These nets are set in both fresh and salt water, but are fished in largest numbers in the rivers.

The number of persons who devoted more or less attention to fyke-net and pot fishing was 2,370, of whom 1,071 were in New York and 764 in Maryland. The nets used numbered 47,635, and were valued at $144,710. In operating them, 2,067 boats were required, which had a value of $56,145. The total investment was thus $200,855, although many of the boats were also employed in other fisheries.

The aggregate catch of these appliances amounted to 6,985,374 pounds, for which the fishermen received $265,652. The yield in New York was 3,357,913 pounds, valued at $108,904. In that State a larger quantity of salt-water fish is taken than else-

where in the region. The values of the fishery in the remaining States were $76,579 in Maryland, $53,679 in New Jersey, $13,170 in Virginia, $6,661 in Delaware, and $6,659 in Pennsylvania. The most important fish taken were eels, flounders, catfish, striped bass, white perch, yellow perch, and shad, in the order named. The small quantities of king crabs and terrapins taken in fyke nets and of lobsters obtained with pots are not included in these figures.

Persons, apparatus, and boats employed in the fyke-net and eel-pot fisheries of the Middle Atlantic States.

States.	No. of persons.	Fyke nets and eel pots.		Boats.		Total invest-ment.
		No.	Value.	No.	Value.	
New York	1,071	21,954	$69,474	*1,026	$31,958	$101,432
New Jersey	307	5,362	18,125	†278	11,087	29,212
Pennsylvania	60	2,534	5,264	59	1,604	6,868
Delaware	76	2,342	2,045	69	985	3,030
Maryland	764	14,994	42,937	564	9,256	52,193
Virginia	92	449	6,865	71	1,255	8,120
Total	2,370	47,635	144,710	2,067	56,145	200,855

* Includes one vessel valued at $700. † Includes two vessels valued at $1,650.

Products of the fyke-net and eel-pot fisheries of the Middle Atlantic States.

Species.	New York.		New Jersey.		Pennsylvania.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives	32,320	$404	200,350	$1,011	5,075	$26
Bluefish	28,350	1,134	1,000	50		
Butter-fish	43,200	648	3,000	150		
Catfish	77,945	3,198	33,565	2,625	82,025	3,482
Eels	1,006,451	61,651	355,380	20,944	27,400	1,386
Flounders	1,064,180	26,488	88,100	3,597		
Frostfish or tomcod	48,600	1,172	1,400	42		
Menhaden	648,000	810	29,167	53		
Perch	20,555	1,453	85,389	6,626	4,350	257
Scup	40,500	810	2,100	105		
Sea bass	8,100	405	1,100	53		
Shad	32,790	2,073	147,024	6,071	475	25
Spots and croakers			6,500	265		
Squeteague	112,970	3,480	12,500	515		
Striped bass	16,305	2,000	35,760	6,350	970	96
Suckers and mullet	16,708	895	45,450	3,576	19,450	978
Tautog or blackfish	18,125	805	5,200	184		
Refuse fish	97,200	243				
Other fish	45,614	1,235	18,925	1,462	6,950	409
Total	3,357,913	108,904	1,071,910	53,679	146,695	6,659

Species.	Delaware.		Maryland.		Virginia.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives			240,200	$1,716	8,300	$163	486,245	$3,320
Bluefish							29,350	1,184
Butter-fish							46,200	798
Catfish	22,200	$1,312	313,225	11,755	37,532	1,310	566,492	23,682
Eels	103,500	4,407	616,140	25,784	4,000	325	2,112,871	114,497
Flounders					15,900	748	1,168,180	30,833
Frostfish or tomcod							50,000	1,214
Menhaden							677,167	863
Perch	11,670	647	411,578	17,919	30,737	1,145	564,279	28,047
Pike			106,244	7,218			106,244	7,218
Scup							42,600	915
Sea bass							9,200	458
Shad	1,001	61	28,487	1,023	37,450	1,183	247,227	10,436
Spots and croakers			3,110	147	44,095	1,678	53,705	2,090
Squeteague			2,450	98	78,149	2,505	206,069	6,598
Striped bass	1,440	167	101,633	7,420	36,814	3,042	192,922	19,075
Suckers and mullet	200	8	50,223	1,397	10,984	300	143,015	7,154
Tautog or blackfish							23,325	989
Refuse fish							97,200	243
Other fish	2,380	59	63,314	2,102	25,900	771	163,083	6,038
Total	142,391	6,661	1,936,604	76,579	329,861	13,170	6,985,374	265,652

THE LINE FISHERIES.

In considering the most primitive means of capture employed in the commercial fisheries of the Middle Atlantic region, it is interesting to observe that lines yield larger money returns than pound nets, although the quantity of fish taken is only half that obtained with pound nets. In New York and New Jersey, in which the pound-net fishery has received most attention from anglers and the general public, the value of the line catch is more than three times as great as the output of pound nets, and the quantity of fish thus taken in the year 1891 was over 3,000,000 pounds more.

Line fishing was followed in 1891 by 4,669 people. More than one-third of these were employed in New Jersey, whose line fisheries for bluefish, sea bass, cod, flounders, and squeteague are very extensive.

The prominent feature of this fishery in New Jersey is the important operations carried on from small boats, while in New York there is a considerable fleet of fine vessels engaged in the line fisheries. Vessel fishing is also relatively important in Pennsylvania, but in the other States only the boat fishery has any prominence. The aggregate amount of money invested in this fishery in 1891 was $386,403, of which New York and New Jersey had $309,205.

The line catch in the entire region was 26,183,621 pounds, valued at $1,003,096. The line fishermen of New Jersey took 14,254,026 pounds, having a value of $543,687. These figures include 6,752,447 pounds of bluefish, worth $242,232, and 3,692,850 pounds of sea bass, worth $146,236, both of which fish are here secured in larger quantities with lines than in any other State. Cod, flounders, and squeteague are also obtained in important quantities in the line fisheries of New Jersey. The professional line fishermen of New York took 6,656,605 pounds of fish, for which they received $276,979, bluefish constituting 3,372,030 pounds, valued at $141,336, and cod 2,277,458 pounds, valued at $89,921. In Pennsylvania most of the line catch is made up of sea bass, in Maryland catfish and squeteague are the more prominent fishes, and in Virginia catfish, squeteague, spots, and croakers constitute most of the yield.

There is in all the coastal States of this region, more especially in New York and New Jersey, an enormous quantity of fish taken by anglers, of which no record can be obtained. The fish thus taken in largest quantities are bluefish, squeteague, sea bass, flounders, and perch.

Persons, vessels, boats, apparatus, and shore property employed in the line fisheries of the Middle Atlantic States.

States.	No. of persons.	Value of lines.	Vessels.			Boats.		Shore property.	Total investment.
			No.	Value.	Value of outfit.	No.	Value.		
New York	1,166	$11,745	43	$100,325	$48,101	394	$30,875	$3,420	$194,466
New Jersey	1,939	5,178	12	18,200	4,746	986	64,130	22,485	114,739
Pennsylvania	488	633	9	15,075	8,710	206	3,237	160	27,815
Delaware	46	20	......	....	....	26	680	85	785
Maryland	762	2,272	......	....	....	524	14,623	3,680	20,575
Virginia	1,268	3,462	2	3,240	620	1,113	16,426	4,275	28,023
Total	5,669	23,310	66	136,840	62,177	3,249	129,971	34,105	386,403

Products of the line fisheries of the Middle Atlantic States.

Species.	New York.		New Jersey.		Pennsylvania.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Black bass			6, 450	$774	20, 310	$2, 107
Bluefish	3, 372, 030	$141, 336	6, 752, 447	242, 232		
Bonito			95, 600	7. 704		
Catfish	22, 210	950	11, 650	816	18, 960	987
Cod	2, 277, 458	89, 921	792, 917	24, 334		
Drum			29, 000	777		
Eels			21, 250	753	11, 225	643
Flounders	107, 737	4, 033	604, 028	21. 018		
Haddock	147, 730	3, 890	17, 940	675		
Hake			12, 080	204		
Kingfish or whiting	16, 630	917	13, 500	801		
Perch	8, 612	448			7, 800	390
Pike					4, 000	600
Sea bass	206, 936	9, 085	3, 692, 850	146, 236	947, 500	33, 805
Sheepshead			2, 100	320		
Skates			7, 050	353		
Spanish mackerel			6, 000	2, 025		
Spots and croakers			86. 200	3, 633		
Squeteague	321, 130	16, 758	1. 991, 364	85, 268		
Striped bass	29, 973	3, 182	14, 975	1, 774	18, 365	1, 778
Tautog	77, 305	3, 720	79, 900	3, 313		
Other fish	68, 854	2, 739	16, 725	677	5, 150	257
Total	6, 656, 605	276. 979	14, 254, 026	543, 687	1, 033, 310	40, 567

Species.	Delaware.		Maryland.		Virginia.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Black bass							26, 760	$2, 881
Bluefish			77, 610	$2, 920	214, 646	$8, 047	10, 416, 733	394, 535
Bonito							95, 600	7, 704
Catfish	5, 000	$330	260, 714	9. 339	340, 452	9, 225	658, 986	21, 647
Cod							3. 070, 375	114, 255
Drum					61, 562	1, 771	90, 562	2, 548
Eels			2, 148	85			34, 623	1, 481
Flounders					45, 510	1. 541	757, 275	26, 592
Haddock							165, 670	4, 565
Hake							12, 080	204
Kingfish or whiting					25, 500	510	55, 630	2, 228
Perch	600	36	41, 085	1, 769	3, 500	210	61, 597	2, 853
Pike			1. 340	81			5, 340	681
Sea bass			3, 370	144	58, 970	1, 900	4, 909, 626	191, 170
Sheepshead			3, 185	396	7, 671	489	12, 956	1, 205
Skates							7, 050	353
Spanish mackerel							6, 000	2, 025
Spots and croakers			98, 988	3, 872	1, 021, 858	34, 844	1, 207, 046	42, 349
Squeteague	26, 300	630	382, 610	10, 906	1, 333, 961	41, 704	4, 055, 365	155, 266
Striped bass	1, 800	216	66, 000	4, 711	19, 875	1, 988	150, 988	13, 649
Tautog	8, 000	320					165, 205	7, 353
Other fish			33, 085	1, 048	94, 340	2, 831	218, 154	7, 552
Total	41, 700	1, 532	970, 135	35, 271	3, 227, 845	105, 060	26, 183. 621	1, 003, 096

THE MENHADEN INDUSTRY.

Fishing for menhaden is prosecuted in all the States of this region except Pennsylvania. The fishery is more important than in any of the other coast sections, and the shore industry dependent thereon is one of the most prominent branches of the fisheries in the Middle Atlantic States.

The industry is most extensive in New York and Virginia. The former State has the larger investment in the business and the greater number of steam vessels engaged, but the latter leads in the number of factories, the number of persons, the aggregate number of vessels engaged, and the quantity of fish taken. In Delaware the fishing is carried on by several steam vessels belonging in Connecticut and landing a part of their catch at the two factories in Delaware. The vessels and their equipment and crews are credited to Connecticut, and do not appear in the accompanying statistics.

The following tables show for each State the extent of the fishery and shore business. It is not possible to present, for each of the years covered by the figures, satisfactorily complete statistics for each State, owing to the different times at which the inquiries in the several States were prosecuted.

Some vessels fishing for menhaden in New Jersey sell large quantities of fish for bait to the professional line fishermen. In 1891, 7,231,500 menhaden were thus sold for $11,575, and 5,197,000 fish, valued at $16,698, were thus utilized in 1892. The largest consumption of menhaden for bait is in the extensive bluefish and sea-bass line fishery of Monmouth County.

Persons engaged in the menhaden industry of the Middle Atlantic States.

States.	Fishermen.				Factory hands.				Total.	
	1889.	1890.	1891.	1892.	1889.	1890.	1891.	1892.	1890.	1891.
New York	517	561	560	(*)	567	617	594	(*)	1,178	1,154
New Jersey	90	102	129	103	108	107	85	78	209	214
Delaware	(†)	(†)	(†)	(†)	(*)	88	90	90	88	90
Maryland	(*)	32	18	(*)	(*)	37	48	(*)	69	66
Virginia	(*)	661	675	(*)	(*)	555	554	(*)	1,216	1,229
Total	....	1,356	1,382	....	....	1,404	1,371	....	2,760	2,753

* Complete data for these years not available.
† Same persons fish for a factory in Connecticut and are properly credited to that State.

Factories, vessels, etc., employed in the menhaden industry of the Middle Atlantic States.

Items.	New York.			New Jersey.				Delaware.		
	1889.	1890.	1891.	1889.	1890.	1891.	1892.	1890.	1891.	1892.
Factories in operation	12	13	13	7	6	6	6	2	2	2
Value of plants	$320,900	$330,600	$327,500	$47,150	$51,650	$52,650	$52,650	$20,000	$20,500	$21,000
Cash capital	$356,000	$386,500	$376,000	$35,000	$41,000	$32,500	$31,500	$13,500	$14,000	$13,000
Steam vessels	24	26	27	3	3	4	3	....	....	....
Value	$210,500	$248,000	$245,000	$24,000	$24,000	$31,000	$23,000	....	....	....
Outfit	$53,125	$56,580	$58,107	$5,168	$5,650	$6,672	$5,938	....	....	....
Tonnage	1,608.20	1,875.02	1,875.02	114.25	114.25	169.58	126.07	....	....	....
Sail fishing vessels	....	....	....	5	6	7	6	....	....	....
Value	....	....	....	$5,800	$5,300	$9,050	$12,000	....	....	....
Outfit	....	....	....	$3,190	$3,650	$4,315	$3,785	....	....	....
Tonnage	....	....	....	100.26	113.63	117.11	137.70	....	....	....
Sail transporting vessels	....	....	....	3	6	5	3	....	....	....
Value	....	....	....	$2,750	$4,050	$3,950	$3,700	....	....	....
Outfit	....	....	....	$355	$530	$441	$381	....	....	....
Tonnage	....	....	....	46.28	76.73	69.41	41.68	....	....	....
Seines	67	74	72	9	10	12	10	....	....	....
Value	$39,250	$43,175	$41,700	$5,150	$5,660	$6,100	$5,450	....	....	....
Total investment	$979,775	$1,064,855	$1,048,307	$128,563	$141,490	$146,678	$138,404	$33,500	$34,500	$34,000

Items.	Maryland.		Virginia.		Total.	
	1890.	1891.	1890.	1891.	1890.	1891.
Factories in operation	1	1	20	21	42	43
Value of plants	$4,500	$4,500	$192,300	$193,900	$599,050	$599,050
Cash capital	$6,000	$6,000	$181,500	$167,000	$628,500	$595,500
Steam vessels	2	1	12	12	43	44
Value	$13,700	$7,200	$99,000	$103,250	$384,700	$386,450
Outfit	$5,860	$3,380	$42,191	$39,525	$110,281	$107,684
Tonnage	138.96	62.54	661.26	637.22	2,789.49	2,744.36
Sail fishing vessels	....	....	31	33	37	40
Value	....	....	$45,710	$51,450	$51,010	$60,500
Outfit	....	....	$35,855	$39,739	$39,505	$44,054
Tonnage	....	....	946.27	1,055.06	1,059.90	1,172.17
Sail transporting vessels	....	....	32	30	38	35
Value	....	....	$31,325	$31,000	$35,375	$34,950
Outfit	....	....	$3,548	$3,326	$4,078	$3,767
Tonnage	....	....	686.80	704.33	763.53	773.74
Seines	4	2	58	60	146	146
Value	$2,800	$1,600	$33,600	$36,600	$85,235	$86,000
Total investment	$32,860	$22,680	$665,029	$665,790	$1,937,734	$1,917,955

Fish utilized and products prepared in the menhaden industry of the Middle Atlantic States.

Items.	New York.			New Jersey.				Delaware.	
	1889.	1890.	1891.	1889.	1890.	1891.	1892.	1891.	1892.
Menhaden utilized (No.)	185,743,850	205,410,300	160,150,450	31,366,000	33,695,100	17,428,800	12,654,500	23,926,500	23,009,000
Value	$301,456	$336,185	$291,165	$33,082	$35,776	$21,189	$19,812	$29,907	$28,760
Gallons oil made	1,257,465	1,310,775	1,118,951	95,270	99,694	72,118	72,657	107,212	105,680
Value	$321,642	$352,793	$282,770	$21,366	$19,636	$18,642	$22,169	$29,093	$27,895
Tons dry scrap made	13,033	14,517	11,406	1,532	1,870	1,098	897	.....	.....
Value	$255,450	$286,396	$230,917	$34,920	$38,980	$27,592	$23,735	.....	.....
Tons crude and acidulated scrap made	3,812	4,657	2,833	1,330	1,100	260	185	3,397	2,986
Value	$46,670	$55,884	$33,996	$12,604	$10,900	$2,366	$2,325	$43,875	$38,826
Total value	$623,762	$695,073	$547,683	$68,890	$69,516	$48,600	$48,229	$72,968	$66,721
Gross profits	$322,306	$358,888	$256,518	$35,808	$33,740	$27,411	$28,417	$43,061	$37,961

Items.	Maryland.		Virginia.		Total.	
	1890.	1891.	1890.	1891.	1890.	1891.
Menhaden utilized (number)	20,579,400	12,500,000	216,400,500	191,365,500	476,085,300	405,371,250
Value	$25,724	$15,625	$237,923	$226,641	$635,608	$584,527
Gallons oil made	30,550	32,900	293,758	396,575	1,734,777	1,727,756
Value	$7,637	$8,225	$70,167	$93,796	$450,233	$432,526
Tons dry scrap made	.....	.....	5,953	5,835	22,340	18,339
Value	.....	.....	$119,938	$119,225	$445,314	$377,734
Tons crude and acidulated scrap made	1,575	1,200	14,053	11,219	21,385	18,909
Value	$30,725	$19,800	$130,570	$111,422	$228,079	$211,479
Total value	$38,362	$28,025	$320,675	$324,443	$1,123,626	$1,021,719
Gross profits	$12,638	$12,400	$82,752	$97,802	$488,018	$437,192

COMPARISONS WITH 1880.

The figures obtained for the Tenth Census permit a fairly satisfactory comparison between the extent and condition of the fisheries of this region in 1880 and 1891. While a somewhat different method of treatment precludes a detailed statistical exposition for the years named, the general comparisons which may be drawn and some special data that may be presented for a number of important items will give a clear idea of the changes which have taken place in the decade indicated.

The fishing population of the Middle Atlantic States in 1880 was ascertained to be 59,853, of whom 44,370 were fishermen proper and 15,483 were shoresmen. In 1891 the number was 90,923, consisting of 73,619 fishermen and 18,304 shoresmen. The increase amounted to 31,070 persons, or about 52 per cent, and was participated in by every State. The increase was apparently most marked in Pennsylvania, in which the figures show an advance of over 400 per cent. While it is known that a large augmentation in the fishing industry of that State has occurred since 1880, it is thought that the very striking increase shown is due to the fact that the oyster vessel-fishery tributary to Philadelphia, which is now very extensive, was not credited to that city in 1880, but to Delaware, in the waters of which State the vessels operated. While Pennsylvania has no oyster-grounds within the limits of the State, a good-sized fleet of vessels owned in Philadelphia engages in the oyster industry of Delaware Bay, and it seems entirely proper to credit this business to Pennsylvania. Next to this State, the greatest increase in fishing population occurred in New York, where it amounted to 93 per cent. The change was least marked in Delaware, in which the advance was only 13 per cent. For the same reason that the advance in Pennsylvania has been apparently more pronounced than was probably the case, that in Delaware has been less so. These remarks apply also to the investment and catch in the two States named.

The investment in the fishing industry in 1880 was $14,596,759; in 1891 it was $4,721,905, or 32 per cent greater. The increase occurred in New York, New Jersey, Pennsylvania, and Maryland, while the other States showed a decline. About 200 fewer vessels were employed in 1891, but the value of vessels in the latter year was somewhat greater, indicating an improvement in their size and quality. The number of boats employed increased about 15,000 and their value $860,000. The use of gill nets, pound nets, fykes, pots, and minor apparatus greatly increased. Perhaps the most remarkable change in respect to the apparatus employed was in the pound nets. Of these, only 348 were operated in 1880, while in 1891 there were 2,414. In Maryland the number rose from 83 to 1,005 and in Virginia from 185 to 941. The only important form of apparatus which underwent a decline was the seine, of which 2,580 were used in the former year and only 1,808 in the latter. The decrease occurred in New York, New Jersey, and Delaware. The shore property connected with the industry was augmented more than 55 per cent, and the cash capital increased about 13 per cent, although in Virginia there was a conspicuous diminution in the last-named item.

Reducing all the products to the common unit of a pound, as explained in the introductory chapter, it appears that in 1880 the yield of the fisheries was 662,789,681 pounds, valued at $16,835,238. The figures for 1891 are 590,454,369 pounds, worth $19,023,474. The apparent inconsistency of a diminished catch and an augmented value is easily understood from an examination of the table. The decreased yield may be regarded as being made up almost wholly of menhaden, of which 148,175,390 fewer pounds were obtained in 1891 than in 1880. The omission of this relatively cheap fish from the statistics would leave the year 1891 with an augmented yield of over 75,000,000 pounds, having a value of over $2,500,000. The fishery objects which have undergone a noticeable increase in importance, as judged by a larger catch, are numerous. Chief among these is the shad, the yield of which was 18,000,000 pounds greater in 1891. The catch of alewives was 15,613,000 pounds more, bluefish 6,826,000 pounds, and sea bass 4,051,000 pounds, the rate of increase for these fish being 148 per cent, 77 per cent, 82 per cent, and 272 per cent, respectively. Cod, scup, sheepshead, Spanish mackerel, and striped bass have decreased in abundance. The figures for oysters show a small increase; soft crabs and round clams present a marked advance; while the yield of soft clams, hard crabs, and terrapins has greatly declined.

The three tables which follow give comparative figures for the fisheries of this region:

Comparative statement of number of persons employed in the fisheries of the Middle Atlantic States in 1880 and 1891.

States.	Fishermen and transporters.		Shoresmen.		Total.		Increase or decrease in 1891.	Percentage of increase or decrease in 1891.
	1880.	1891.	1880.	1891.	1880.	1891.		
New York	4,728	11,204	1,616	2,042	6,344	12,246	+ 5,902	+ 93.03
New Jersey	5,659	10,107	561	532	6,220	10,639	+ 4,419	+ 71.05
Pennsylvania	397	1,984	41	289	438	2,273	+ 1,835	+418.95
Delaware	1,662	1,799	317	431	1,979	2,230	+ 251	+ 12.68
Maryland	15,873	28,209	10,135	11,735	26.008	39,944	+13,936	+ 54.43
Virginia	16,051	20,316	2,813	3,275	18,864	23,591	+ 4,727	+ 25.66
Total	44,370	73,619	15,483	18,304	59,853	90,923	+31,070	+ 51.91

Comparative statement of the vessels, boats, apparatus, shore property, and capital employed in the fisheries of the Middle Atlantic States in 1880 and 1891.

Designation.	New York.				New Jersey.			
	1880.		1891.		1880.		1891.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels	540	$774, 000	659	$817, 542	590	$545, 900	607	$649, 670
Boats	3, 270	279, 885	6, 227	373, 670	4, 065	223, 963	5. 742	412, 373
Seines	1, 565	127, 063	327	75, 640	435	38, 570	372	38, 022
Gill nets	3, 366	70, 627	6, 402	88, 450	852	25, 203	3, 983	129, 832
Pound nets and weirs	53	29, 500	263	71, 340	27	19, 800	185	55, 370
Fyke nets and pots	3, 950	6, 750	22, 144	72, 856	3, 417	15, 966	6. 447	24, 220
Miscellaneous apparatus and outfit	....	116, 310	....	309. 733	....	132. 800	....	209, 967
Shore property	....	1, 046, 900	....	1, 794, 969	....	470, 000	....	409, 561
Cash capital	....	119, 500	....	1, 679, 000	....	20, 000	....	538, 850
Total	....	2, 570, 535	....	5, 283, 200	....	1, 492, 202	....	2, 467, 865

Designation.	Pennsylvania.				Delaware.			
	1880.		1891.		1880.		1891.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels	11	$10, 500	49	$87, 775	69	$51, 600	41	$34, 775
Boats	119	9, 572	837	30, 652	839	33, 227	946	29, 233
Seines	42	8, 260	151	19, 405	245	21, 330	203	10, 263
Gill nets	167	4, 744	209	21, 450	1, 457	27, 793	1, 586	33, 946
Pound nets and weirs	....	....	....	....	....	....	20	305
Fyke nets and pots	2, 167	4, 334	2, 534	5, 264	1, 831	1, 831	2, 382	2, 145
Miscellaneous apparatus and outfit	....	4. 700	....	25, 682	....	19, 370	....	8, 215
Shore property	....	50, 000	....	450, 162	....	105, 080	....	44, 800
Cash capital	....	3, 000	....	303, 750	....	8, 000	....	44, 400
Total	....	95, 110	....	944. 140	....	268, 231	....	208, 082

Designation.	Maryland.				Virginia.			
	1880.		1891.		1880.		1891.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels	1, 450	$1. 750, 000	1, 627	$1, 446, 855	1, 446	$571, 000	944	$740, 135
Boats	2, 825	186, 448	9, 825	579, 488	6, 618	292, 720	9, 247	463, 722
Seines	140	53, 950	536	76, 780	153	70, 970	219	58, 120
Gill nets	1. 462	44, 880	11, 999	100, 014	3, 532	35. 220	5, 979	46, 030
Pound nets and weirs	83	13, 375	1, 005	71, 778	185	98. 390	941	166, 990
Fyke nets and pots	4. 050	6, 600	14, 994	42, 937	100	909	449	5, 865
Miscellaneous apparatus and outfit	....	178, 340	....	595, 084	....	355, 283	....	282, 510
Shore property	....	1. 611, 700	....	2. 446, 327	....	489, 636	....	717. 787
Cash capital	....	2. 497, 150	....	2, 107, 455	....	1, 914, 119	....	467, 500
Total	....	6. 342, 443	....	7. 466, 718	....	3, 828, 238	....	2, 948, 659

Designation.	Total.				Increase or decrease in value in 1891.	Percentage of increase or decrease in value in 1891.
	1880.		1891.			
	Number.	Value.	Number.	Value.		
Vessels	4, 106	$3, 703, 000	3, 927	$3, 776, 752	+ $73, 752	+ 1. 99
Boats	17, 736	1, 025, 815	32, 824	1. 889, 138	+ 863, 323	+ 84. 16
Seines	2, 580	320, 143	1, 808	278, 230	— 41, 913	— 13. 09
Gill nets	10, 836	208, 467	30, 158	419, 722	+ 211. 255	+101. 34
Pound nets and weirs	348	161, 065	2, 414	365, 783	+ 204, 718	+127. 10
Fyke nets and pots	15, 515	36, 381	48, 950	153, 287	+ 116, 906	+321. 31
Miscellaneous apparatus and outfit	....	806. 803	....	1, 431, 191	+ 624, 388	+ 77. 39
Shore property	....	3, 773, 316	....	5, 863, 606	+2, 090, 290	+ 55. 40
Cash capital	....	4, 561, 769	....	5, 140, 955	+ 579, 186	+ 12. 70
Total	....	14, 596, 759	....	19, 318, 664	+4, 721, 905	+ 32. 35

Comparative statement of the products of the fisheries of the Middle Atlantic States in 1880 and 1891.

Products	New York.		New Jersey.		Pennsylvania.		Delaware.	
	1880.	1891.	1880.	1891.	1880.	1891.	1880.	1891.
Fish:	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Alewives	250,000	2,194,560	1,500,000	2,066,820	(*)	2,331,775	2,396,700	863,760
Bluefish	3,000,000	5,506,575	3,635,000	7,227,926	30,000		45,800	
Butter-fish	500,000	837,246	200,000	230,802				
Catfish	50,000	117,180	135,000	133,824	117,000	132,468	196,200	73,800
Cod	3,580,000	2,277,458	1,667,000	841,011				
Eels	1,361,300	1,616,213	551,000	623,280	(*)	40,950	124,000	223,500
Flounders	1,000,000	1,561,696	75,000	987,895			16,500	5,000
Kingfish	40,000	157,541	15,000	33,697			3,500	960
Menhaden	288,931,200	104,860,114	29,134,600	20,670,542			522,900	67,000
Perch	545,000	88,125	630,000	693,962	60,000	18,645	476,500	255,855
Scup	1,500,000	350,858	50,000	25,682				
Sea bass	750,000	679,180	160,000	3,731,538	550,000	947,500	1,200	
Shad	2,733,600	3,044,956	864,000	10,225,455	559,600	2,692,864	1,050,000	1,500,196
Sheepshead	400,000	19,523	275,090	26,290	5,000		5,900	
Spanish mackerel	25,000	74,836	200,000	78,391				
Spots and croakers	235,000	17,501	250,000	106,680			674,100	42,460
Squeteague	4,000,000	2,852,653	4,430,000	6,002,563	15,000		2,618,500	1,164,730
Striped bass	795,000	205,449	442,000	298,164	43,400	24,615	247,900	94,910
Sturgeon	144,000	30,261	300,000	452,630	150,000	52,700	570,000	1,304,800
All others	4,054,140	2,250,506	1,384,226	768,902	150,000	158,440	731,850	117,280
Total	313,894,240	128,742,431	45,897,826	55,226,054	1,680,000	6,399,957	9,681,550	5,714,251
Reptiles, mollusks, and crustaceans:								
Terrapins	1,800		9,000	3,280			30,708	11,988
Turtles							15,300	18,000
Clams, soft or long	3,407,750	1,505,500	660,280	827,000				
Clams, hard or round	2,795,840	4,524,520	3,132,280	3,454,024			5,544	21,920
Oysters	7,303,100	18,277,434	13,825,000	16,114,567		1,183,700	2,100,000	1,097,040
Scallops	290,500	313,042						
Shells		16,766,100						
Crabs	1,624,583	529,066	1,470,300	519,611			84,951	86,250
Lobsters	135,000	165,093	156,800	165,664			150	8,200
All others		61,836		2,806,180				740,000
Total	15,558,573	42,142,591	19,253,660	23,890,326		1,183,700	2,236,653	1,983,398
Grand total	329,452,813	170,885,022	65,151,486	79,116,380	1,680,000	7,583,657	11,918,203	7,697,649
Value	$4,225,695	$4,817,369	$3,176,589	$3,520,057	$83,100	$322,021	$997,695	$255,423

Products.	Maryland.		Virginia.		Total.		Increase or decrease.	
	1880.	1891.	1880.	1891.	1880.	1891.	Quantity.	Per cent.
Fish:	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	
Alewives	9,203,959	17,418,850	6,925,413	11,013,485	20,276,072	35,889,250	+15,613,178	+ 77.00
Bluefish	10,000	516,364	1,546,417	1,842,264	8,267,217	15,093,129	+ 6,825,912	+ 82.57
Butter-fish		31,955		120,000	700,000	1,220,003	+ 520,003	+ 74.29
Catfish	420,000	1,296,752	500,000	935,244	1,418,200	2,689,268	+ 1,271,068	+ 89.63
Cod					5,247,000	3,118,469	— 2,128,531	— 40.57
Eels	15,000	792,044	125,000	71,619	2,176,300	3,367,606	+ 1,191,306	+ 54.74
Flounders	5,000	33,443	40,000	127,295	1,136,500	2,715,329	+ 1,578,829	+ 138.92
Kingfish	3,000		175,000	149,565	236,500	341,763	+ 105,263	+ 44.51
Menhaden	3,903,000	30,952,120	88,213,800	105,980,334	410,705,500	262,530,110	—148,175,390	— 36.08
Perch	890,000	2,494,625	745,000	468,833	3,346,500	4,020,045	+ 673,545	+ 20.13
Scup					1,550,000	376,540	— 1,173,460	— 75.71
Sea bass	5,000	113,370	20,000	66,310	1,486,200	5,537,898	+ 4,051,698	+ 272.62
Shad	3,774,426	6,224,873	3,171,953	6,498,242	12,153,579	30,186,586	+18,033,007	+ 148.38
Sheepshead	12,000	3,185	503,666	23,871	1,201,566	72,869	— 1,128,697	— 93.94
Spanish mackerel	18,000	44,837	1,609,663	739,910	1,852,663	937,974	— 914,689	— 49.37
Spots and croakers	40,000	273,283	1,150,000	1,725,847	2,349,100	2,165,771	— 183,329	— 7.80
Squeteague	65,000	750,465	1,476,000	3,929,899	12,604,500	14,700,310	+ 2,095,810	+ 16.63
Striped bass	700,000	1,264,693	625,000	483,436	2,853,300	2,371,267	— 482,033	— 16.89
Sturgeon	144,000	72,445	411,558	723,646	1,719,558	2,636,482	+ 916,924	+ 53.32
All others	1,067,518	1,416,353	1,106,279	2,242,958	8,494,013	6,954,439	— 1,539,574	— 18.13
Total	20,275,903	63,699,657	108,344,749	137,142,758	499,774,268	396,925,108	—102,849,160	— 20.58
Reptiles, mollusks, and crustaceans:								
Terrapins	30,000	89,780	165,600	52,215	237,108	157,263	— 79,845	— 33.67
Turtles		4,060		189,121	15,300	211,181	+ 195,881	+ 1280.27
Clams, soft or long					4,068,030	2,332,500	— 1,735,530	— 42.66
Clams, hard or round	40,000	147,760	363,820	559,278	6,337,484	8,707,502	+ 2,370,018	+ 37.40
Oysters	74,200,000	69,615,406	47,861,240	43,134,602	145,289,340	149,422,749	+ 4,133,409	+ 2.84
Scallops					290,500	313,042	+ 22,542	+ 7.76
Shells						16,766,100	+16,766,100	
Crabs	1,166,667	7,605,770	2,139,200	2,894,027	6,485,701	11,634,724	+ 5,149,023	+ 79.39
Lobsters					291,950	338,957	+ 47,007	+ 16.10
All others		15,394		21,833		3,645,243	+ 3,645,243	
Total	75,436,667	77,478,170	50,529,860	46,851,076	163,015,413	193,529,261	+30,513,848	+ 18.72
Grand total	95,712,570	141,177,827	158,874,609	183,993,834	662,789,681	590,454,369	-72,335,312	— 10.91
Value	$5,221,715	$6,460,759	$3,124,444	$3,647,845	$16,835,238	$19,023,474	+$2,188,236	+ 13.00

* Not separately reported and included in "all others."

22.—A LIST OF THE SPECIES OF FISHES KNOWN FROM THE VICINITY OF NEOSHO, MISSOURI.

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This paper is based upon a small collection of fishes which was made October 27 to 30, 1891, in the vicinity of Neosho, Mo., by Prof. Evermann, assisted by Dr. J. T. Scovell, of Terre Haute, Ind. Collections were made in Indian Creek, a few miles south of Neosho, and in the Spring Branch, which supplies water for the United States fish-hatchery at Neosho.

In 1889, Prof. Seth E. Meek, while engaged in investigations for the U. S. Fish Commission, in Missouri, made some collections near Neosho, in Shoal Creek, and in Hickory Creek, one of its small tributary streams. Subsequently he obtained a few specimens from the Spring Branch at the fish-hatchery. In this paper we have included all the species of these various collections.

Indian Creek is a stream of fair size, having its rise in the southeastern part of Newton County; flowing southwest some 30 miles, it joins Elk River a few miles below Pineville, the county seat of McDonald County, which is the southwest-corner county of the State. Elk River flows into Neosho River a short distance west of the Missouri line. Indian Creek is a moderately clear stream, with rock, gravel, or mud bottom, usually shallow and with some current, but with occasional deep holes with muddy bottom and scarcely any current.

The following list represents only approximately the fishes of the region, but may be regarded as fairly complete as to the species inhabiting the smaller streams.

In the larger streams, such as Spring River on the north, Neosho River on the west, and White River to the southeast, many additional species are known to occur, not only of *Cyprinidæ* but of the larger river fishes, such as the channel cat (*Ictalurus punctatus*), *Ameiurus*, *Ictiobus*, and the like.

This list contains 34 species, representing 8 families, as follows: *Siluridæ*, 1; *Catostomidæ*, 3; *Cyprinidæ*, 14; *Pœciliidæ*, 1; *Atherinidæ*, 1; *Centrarchidæ*, 4; *Percidæ*, 9; and *Cottidæ*, 1. Or 17 genera, distributed as follows: *Noturus*, 1; *Catostomus*, 2; *Moxostoma*, 1; *Campostoma*, 1; *Chrosomus*, 1; *Hybognathus*, 1; *Pimephales*, 1; *Notropis*, 6; *Hybopsis*, 2; *Semotilus*, 1; *Tinca*, 1; *Zygonectes*, 1; *Labidesthes*, 1; *Lepomis*, 3; *Micropterus*, 1; *Etheostoma*, 9; *Cottus*, 1.

1. **Noturus exilis** Nelson. *Stone Cat.* Two specimens, $1\frac{1}{2}$ and 3 inches long, from Indian Creek. One 3 inches long, taken by Prof. Meek from the Spring Branch, and others reported by him from the same place.
2. **Catostomus teres** (Mitchill). *Common Sucker.* Two specimens, $4\frac{1}{2}$ and $8\frac{1}{4}$ inches long, from Indian Creek; one $10\frac{1}{2}$ inches long from the Spring Branch, and by Dr. Meek reported common in Shoal Creek.
3. **Catostomus nigricans** Le Sueur. *Hog Sucker; "Hog Molly."* One specimen, $3\frac{1}{4}$ inches long, from Indian Creek. Reported scarce in Shoal Creek by Dr. Meek.
4. **Moxostoma duquesnei** (Le Sueur). *Common Redhorse; White Sucker.* Two specimens, $4\frac{1}{2}$ and $5\frac{1}{4}$ inches long, from Indian Creek; reported common, by Dr. Meek, in Shoal Creek.
5. **Campostoma anomalum** (Rafinesque). *Stone Roller.* Three specimens from Indian Creek and two from the Spring Branch, the longest of which was $3\frac{5}{8}$ inches, the shortest $2\frac{1}{8}$, and the average length about 3 inches. Dr. Meek reported this spacies common in Shoal Creek.
6. **Chrosomus erythrogaster** Rafinesque. *Red-bellied Minnow.* Three specimens from the Spring Branch, and five taken by Dr. Meek from the same place. The longest of 8 specimens is $2\frac{5}{8}$ inches, the shortest $2\frac{3}{8}$, and the average $2\frac{1}{2}$ inches long. Reported abundant by Prof. Meek in Shoal Creek.
7. **Hybognathus nubila** (Forbes). Six examples from Indian Creek, where it is common. The smallest is $2\frac{1}{4}$ inches long, the largest $2\frac{7}{8}$ inches, and the average is $2\frac{3}{8}$ inches. Reported by Dr. Meek as abundant in Shoal Creek.
8. **Pimephales notatus** (Rafinesque). One specimen, $2\frac{5}{8}$ inches long, from Indian Creek. Abundant in Shoal Creek.
9. **Notropis shumardi** (Girard). Head, 4; depth, $4\frac{1}{2}$; eye, $2\frac{1}{3}$; snout, $3\frac{3}{4}$; D. 8; A. 8; scales, 6–36–3, 12 to 14 scales before the dorsal. Dorsal fin rather high, its anterior rays nearly as long as head, the last ray $2\frac{1}{2}$ in first ray; origin of dorsal somewhat behind base of ventrals, nearer tip of snout than base of caudal; pectorals long, not quite reaching base of ventrals, $1\frac{2}{3}$ in head; anal small, its longest ray $1\frac{2}{3}$ in head; caudal deeply forked. Head rather heavy; snout shorter than eye, rather blunt; mouth rather large, oblique, jaws subequal; maxillary reaching orbit, 3 in head. Teeth, 1, 4–4, 1, hooked, and with slight grinding surface. Two specimens, each $2\frac{3}{4}$ inches long, from Indian Creek, which we refer to this species. The mouth is somewhat larger and the snout more blunt than in typical *shumardi*.
10. **Notropis illecebrosus** (Girard). One small specimen of this species from the Spring Branch at Neosho.
11. **Notropis galacturus** (Cope). *Milky-tail Minnow.* Obtained in Shoal Creek, where it is said not to be common.
12. **Notropis megalops** (Rafinesque). *Common Shiner.* Not obtained by us, but found by Dr. Meek to be very common in Shoal Creek.
13. **Notropis zonatus** (Agassiz).

Alburnus zonatus Agassiz, in Putnam, Bull. Mus. Comp. Zool., I, 9, 1863. Type locality: Osage River, Missouri.

Teeth 1, 4–4, 1, hooked and with slight grinding surface. Head, 4; depth, $4\frac{3}{4}$; eye, 3; snout, $3\frac{1}{3}$. D. 8; A. 9; scales, 7 or 8–42–3 or 4, 14 before dorsal. Height of dorsal $1\frac{1}{4}$ in head, its origin over base of ventrals equally distant between tip of snout and base of caudal. Head less pointed than in *N. rubrifrons*; mouth smaller, maxillary scarcely reaching eye. Color essentially as in *N. rubrifrons*, the black dorsal line rather more distinct; lateral line less decurved and the pores less plainly marked. We have examined 31 specimens of this species, 20 from Indian Creek and 11 from Spring Branch. The average length of these 31 specimens is nearly 3 inches; the shortest is 2 inches, the longest $3\frac{4}{5}$ inches. It was found by Prof. Meek to be abundant in Shoal Creek.

14. **Notropis rubrifrons** (Cope). Three specimens from Indian Creek; common in Shoal Creek. Head, 4; depth, $4\frac{3}{4}$; eye, $3\frac{1}{3}$; snout, $3\frac{1}{3}$. D. 8; A. 9; scales, 6–37–3. Dorsal moderate, its longest ray $1\frac{1}{2}$ in head, origin considerably behind base of ventrals, much nearer base of caudal than tip of snout. Mouth large, oblique, maxillary reaching past front of eye; snout pointed; jaws subequal, or lower one slightly projecting. Lateral line decurved. A small, straw-colored minnow with a narrow black line along middle of back and a broad silvery lateral band edged with plumbeous above.

15. Hybopsis amblops (Rafinesque). One specimen, $2\frac{1}{2}$ inches long, taken from Indian Creek, and a few recorded by Dr. Meek from Shoal Creek.

16. Hybopsis kentuckiensis (Rafinesque). *River Chub; Jerker.* Eight specimens from Indian Creek, 3 specimens taken by Dr. Meek from the Spring Branch, and reported common in Shoal Creek. Of 11 specimens, the longest is $4\frac{1}{8}$, the shortest $1\frac{1}{2}$, and the average length a little over 2 inches.

17. Semotilus atromaculatus (Mitchill). *Creek Chub.* Not found by us, but obtained by Dr. Meek in Shoal Creek.

18. Tinca tinca (Linnæus). *Tench.* This European cyprinoid, which is one of the species reared at the Neosho fish-hatchery, has escaped into Spring Branch, where young individuals were quite common.

19. Zygonectes macdonaldi Meek.

Zygonectes macdonaldi Meek, Bull. U. S. Fish Comm., IX, 1889, 122, pl. 42, fig. 1. Type locality: Jones Creek, near Dixon, Mo., and Osage Fork of the Gasconade, near Marshfield, Mo.

This species, described by Prof. Meek from the localities mentioned above, was also obtained by him at Neosho. It was found by us to be a very common fish in the Spring Branch. In 17 examples examined the length varied from $1\frac{1}{2}$ inches to $2\frac{3}{8}$ inches, the average length being about 2 inches.

20. Labidesthes sicculus Cope. *Brook Silverside; Skipjack.* Three specimens from Indian Creek, measuring $2\frac{3}{8}$, $2\frac{5}{8}$, and $2\frac{3}{4}$ inches in total length, respectively. A single specimen obtained in Shoal Creek by Dr. Meek.

21. Lepomis cyanellus Rafinesque. *Green Sunfish.* Three specimens from the Spring Branch and one from Indian Creek, measuring $3\frac{7}{8}$, $1\frac{6}{8}$, $1\frac{6}{8}$, and $1\frac{1}{2}$ inches respectively.

22. Lepomis megalotis (Rafinesque). *Long-eared Sunfish.* One specimen from Indian Creek, $3\frac{1}{2}$ inches long. Reported very abundant, by Dr. Meek, in Shoal Creek.

23. Lepomis pallidus (Mitchill). *Blue-gill; Blue Bream.* One specimen, $3\frac{1}{2}$ inches long, from Spring Branch.

24. Micropterus dolomieu Lacépède. *Small-mouthed Black Bass.* Not taken by us, but obtained by Prof. Meek in Shoal Creek.

25. Etheostoma nigrum Rafinesque. Seven specimens from Indian Creek, the longest being $2\frac{7}{8}$, the shortest $1\frac{5}{8}$, and the average about 2 inches long. Dorsal VIII, 12 in 4 of the 7 examples, instead of IX, 12.

26. Etheostoma blennioides Rafinesque. Two specimens, $3\frac{1}{2}$ and 2 inches in length, from Indian Creek.

27. Etheostoma copelandi (Jordan). Three specimens obtained in Shoal Creek.

28. Etheostoma caprodes Rafinesque. *Log Perch.* One specimen, $5\frac{1}{2}$ inches in length, from Indian Creek.

29. Etheostoma zonale (Cope). Three specimens from Indian Creek. Scales 6–52–9, 6–58–9, and 6–55–7. The 3 specimens are $2\frac{1}{2}$, $2\frac{1}{4}$, and $2\frac{1}{8}$ inches long, respectively.

30. Etheostoma flabellare Rafinesque. Two specimens obtained by Prof. Meek in Shoal Creek.

31. Etheostoma whipplei (Girard). There is one small darter, 2 inches long, from Indian Creek, which seems to be this species, though it does not wholly agree with specimens collected in the Sallisaw River, at Mackey, Ind. T., by Prof. Meek, and identified by him and us as *E. whipplei.* The following is a description of our specimen: Head,* 3 ($3\frac{1}{2}$); depth, 5; eye, 4 ($3\frac{1}{2}$); snout, $4\frac{1}{5}$ ($3\frac{5}{6}$). D. XI, 13; A. II, 9; scales, 11–63–11, the lateral line developed on about 34 scales, not arched above base of pectoral. Cheeks with fine imbedded scales; opercles almost naked; breast and nape with very fine scales; middle line of belly with ordinary scales. Head moderate; mouth large, terminal, but little oblique, the maxillary reaching vertical of pupil; premaxillaries not protractile; gill membranes scarcely connected. Body deep, compressed, back somewhat elevated; caudal peduncle compressed and deep, the least depth $2\frac{3}{4}$ in head with opercular flap. Everywhere densely covered with minute coffee-colored specks.

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* In obtaining the number inside the parenthesis the opercular flap was not included in the length of the head.

32. Etheostoma pagei Meek.

Etheostoma pagei Meek. American Naturalist, November, 1894, 957.

This interesting darter was described by Dr. Meek from 2 specimens obtained by him in the Spring Branch on the U. S. Fish Commission grounds at Neosho, and was named for Mr. W. F. Page, superintendent of the Government fish-hatchery at that place. The original description is as follows: Head, $3\frac{1}{2}$ in length of body; depth, 4 to $4\frac{1}{2}$; eye, $3\frac{1}{2}$ in head; snout, $3\frac{1}{2}$; dorsal fin with 9 or 10 spines and 12 or 13 soft rays; anal spines, 2; soft rays, 7; scales, 8-56 to 61-13. Body robust; snout abruptly decurved, but not blunt; mouth rather large, terminal, maxillary reaching vertical from pupil; premaxillaries not protractile; lips thick; gill membranes not connected; cheeks, opercles, and breast naked; nape scaled; lateral line imperfect, developed on only about 12 scales. Color of male: Belly bright red, extending on side to upper rays of pectoral fins; above the red is a yellowish band on the sides about as wide as diameter of eye; upper part of body olivaceous, with darker markings, each scale being provided with a black spot, these making faint lateral streaks along the rows of scales; about 9 dark blotches on the side, resembling faint bars. Caudal and soft dorsal fins barred; pectorals faintly barred; anal and ventrals plain; a dark numeral scale. The female has the under parts whitish, the sides olivaceous, much mottled with darker; otherwise as in the male. Length, 2 inches. Only the types known.

33. Etheostoma cœruleum spectabile (Agassiz). *Rainbow Darter.* This is the most abundant darter in Spring Branch and in Shoal Creek. It is also common in Indian Creek. Of 24 examples examined by us all are of the small brook form described as *spectabile*. The males were all extremely brilliant in life. The average length of the 24 specimens is $2\frac{1}{6}$ inches.

34. Cottus bairdi Girard. *Blob; Miller's Thumb.* Four specimens from Indian Creek, 2 to $3\frac{1}{2}$ inches long. Common in Shoal Creek.

23.—THE FISHES OF THE COLORADO BASIN.

BY BARTON W. EVERMANN AND CLOUD. RUTTER.

In this paper we have attempted to indicate in succinct form our present knowledge of the geographic distribution of the fishes in the basin of the Colorado River of the West. The approximate area drained by the Colorado and its tributary streams is 225,049 square miles. This embraces all of the Territory of Arizona, a narrow strip along the entire length of the western side of New Mexico, a large part of western Colorado, a portion of southwestern Wyoming, nearly all of the eastern half of Utah and a narrow strip in the southwestern part of that Territory, and a small portion of the comparatively arid region of southeastern California.

The Colorado is more than 1,200 miles in length, and is, next to the Columbia, the greatest river of our Western States. It has its rise in the Wind River Mountains of western Wyoming, near the headwaters of four other great rivers, the North Platte, the Big Horn, the Yellowstone, and the Snake, and flows southward through Wyoming into Utah, just touching the northwest corner of Colorado. Until joined by the Grand River in Utah, in about latitude 40° 20′, it is known as the Green River. The area drained by the Green River is about 47,222 square miles. Near the middle of the south line of Utah the Colorado passes into Arizona, then, flowing westward through the Grand Canyon, reaches the Nevada line. After receiving the Rio Virgen from the north, the Colorado turns abruptly southward and pursues this general direction until it reaches the Gulf of California, into which it flows about 50 miles south of the international boundary. It forms over two-thirds of the boundary line between Arizona and Nevada, and all of that between Arizona and California.

The following is a classified list of the rivers and more important creeks of the Colorado Basin. Those in which collecting has been done are printed in italics:

- *Colorado River:*
  - *Gila River.*
    - *Santa Cruz River.*
    - *San Pedro River.*
      - Babacomari River.
    - *Salt River.*
      - *White Mountain Creek.*
    - Aqua Frio Creek.
  - Cataract Creek.
  - Little Colorado River.
    - *Zuñi River.*
  - San Juan River.
    - *Rio de las Animas Perdidas.*
      - *Mineral Creek.*
      - *Leiter Creek.*
      - *Rio Florida.*
      - *Rio de las Piedras.*
    - *Pagosa Springs.*

- *Colorado River*—Continued.
  - Grande River.
    - *Gunnison River.*
      - *Uncompahgre River.*
    - *Cimarron Creek.*
      - *Tomichi Creek.*
    - *Sweetwater Lakes.*
    - *Trapper Lake.*
    - *Eagle River.*
    - *Roaring Fork.*
    - *Cañon Creek.*
  - *Green River.*
    - White River.
    - Yampa River.
      - Little Snake River.
    - Duchesne River.
    - San Rafael River.
    - Dirty Devil River.
    - *Price River.*
    - *Virgen River.*

The principal tributaries from the east are the Rio Gila (draining 68,623 square miles) and the Little Colorado or Colorado Chiquito (draining 29,268 square miles), in Arizona; the San Juan in New Mexico, Colorado, and Utah (draining 26,472 square miles); the Grand, White, and Yampa in Colorado, and the Big Sandy River in Wyoming. The streams from the west are few and rather small, the Duchesne, Price, and Virgen being the only ones of any importance. The tributaries from Colorado are all clear, cold, mountain streams well suited to trout; the headwaters of Green River are similar in character; while the tributaries from Utah, Nevada, California, and Arizona are from comparatively arid regions. During time of rains these streams become of considerable size and are very turbid from the easily eroded country through which they flow. They decrease in size as readily, and in some cases disappear in the sand. Such streams are of course unsuited to a large variety of fish life.

While the headwaters of the Colorado are ordinarily clear and pure, the lower Colorado is one of the muddiest rivers in America and is unfit for any but mud-loving species. As already pointed out by Dr. Jordan,* the headwaters are well supplied with trout, accompanied by *Agosia yarrowi* and the blob (*Cottus bairdi punctulatus*). Lower down appear four species of suckers (*Xyrauchen cypho*, *X. uncompahgre*, *Catostomus latipinnis*, and *Pantosteus delphinus*), and with them the round-tail (*Gila robusta*), the "white salmon" (*Ptychocheilus lucius*), and Williamson's whitefish (*Coregonus williamsoni*). Still lower down are found the bony-tail (*Gila elegans*) and other species of *Catostomus*, while in the Arizona region and the other arid portions are found the peculiar genera *Lepidomeda*, *Meda*, and *Plagopterus*.

Very little collecting has been done in the Colorado Basin, the following being a list of all the collections, or at least all those which have been reported upon and the literature of which is accessible to us:

1. Three nominal species collected by Dr. S. W. Woodhouse, naturalist to Capt. Sitgreaves's expedition, 1852. These were described by Baird & Girard in 1853.

2. Eighteen nominal species collected by the naturalists of the Pacific Railroad Survey and of the United States and Mexican Boundary Survey (John H. Clark, John L. Le Conte, Arthur Schott, Dr. C. B. Kennerly, and Dr. A. L. Heermann). These constituted the first considerable collections, and were described by Baird & Girard, or Girard alone, in 1853–56.

3. Thirteen nominal species obtained by Campbell Carrington, naturalist to the Hayden surveys of 1870 and 1871. These collections were studied and reported upon by Prof. Cope, in 1871 and 1872.

4. Twenty-seven nominal species collected by the various naturalists of the Wheeler Survey (Cope, Yarrow, Henshaw, Newberry, Klett, Rothrock, Rutter, Loew, Bischoff, and Birnie) in 1871–74. These are by far the most extensive collections which have as yet been made in this region, and formed the basis for the admirable report by Cope & Yarrow in volume 5 of the Wheeler Reports and for Prof. Cope's valuable paper on the Plagopterinæ and the Ichthyology of Utah, in 1874.

5. One species (*Xyrauchen cypho*) obtained at the mouth of the Gila, and described by Mr. William N. Lockington in 1880.

6. Seven nominal species collected at Fort Thomas, Ariz., by Lieut. W. L. Carpenter, U. S. A. These were reported upon by Philip H. Kirsch in 1889.

*Bull. U. S. Fish Commission, IX, 1889 (1891), 22.

7. Eleven nominal species collected in Colorado and Utah in 1889 by Dr. David S. Jordan, Prof. Barton W. Evermann, Mr. Bert Fesler, and Mr. Bradley M. Davis. These were reported upon by Dr. Jordan in 1890.

8. One species (*Gila robusta*) collected in Babacomari Creek near Fort Huachuca, Ariz., in May, 1892, by Dr. A. K. Fisher, to whom we are indebted for the privilege of examining these and other fishes collected by him.

9. Seven species obtained by the present writers from Green River at Green River, Wyo., in 1893. The report upon these species is contained in this paper.

10. Collections have recently been made at Yuma and elsewhere in Arizona by Dr. Charles H. Gilbert, but other than describing one new species he has not yet published the results.

The fish fauna of the Colorado Basin is not rich in number of species, the total number now recognized being but 32 native species. These represent 5 families and 18 genera, as follows:

Catostomidæ, 8 species: *Pantosteus*, 3; *Catostomus*, 3; *Xyrauchen*, 2.

Cyprinidæ, 19 species: *Ptychocheilus*, 1; *Gila*, 3; *Leuciscus*, 4; *Tiaroga*, 1; *Rhinichthys*, 1; *Agosia*, 4; *Couesius*, 1; *Lepidomeda*, 2; *Meda*, 1; *Plagopterus*, 1.

Salmonidæ, 2 species: *Salmo*, 1; *Coregonus*, 1.

Pœciliidæ, 2: *Cyprinodon*, 1; *Heterandria*, 1.

Cottidæ, 1: *Cottus*, 1.

Though the families and species constituting the fish fauna are very few, they are of unusual interest to the student of geographic distribution.

The Cyprinidæ, or minnow family, is by far the most important family as to the number of species, embracing as it does almost 60 per cent of the entire number. The Catostomidæ, or sucker family, comes next, with 8 species, or 25 per cent of the total number. Of the 18 genera, *Xyrauchen*, *Gila*, *Tiaroga*, *Meda*, and *Plagopterus* are thus far known only from the Colorado Basin; *Lepidomeda* was not known to occur elsewhere, until recently discovered by Dr. Gilbert among the fishes collected in the Great Basin in southwestern Nevada by the Death Valley expedition; *Ptychocheilus* is a Pacific Coast genus, represented in most of the larger streams of California, Oregon, and Washington; *Pantosteus*, *Agosia*, and *Heterandria*, as now limited, are genera of rather wide distribution in the western part of the United States; while the 8 remaining genera are found throughout middle North America.

Of the 32 species, all but 7 are thus far known only from this basin. The 7 species which are not confined to the Colorado Basin are the Utah chub (*Leuciscus lineatus*), the western dace (*Rhinichthys cataractæ dulcis*), *Agosia chrysogaster*, Williamson's whitefish, the blob, *Lepidomeda vittata*, and *Girardinus macularius*. The home of the Utah chub is in the Utah and Upper Snake River basins. The western dace belongs in the headwaters of the Missouri, Platte, Arkansas, and Rio Grande, and in the Utah and Columbia basins. Williamson's whitefish and the blob occur in the headwaters of all of our western rivers. *Lepidomeda vittata*, the fifth species, has been taken only once outside of the Colorado Basin. It is thus seen that over 78 per cent of the species of fishes now known from the Colorado Basin are peculiar to it. This is a larger percentage of species peculiar to a single river basin than is found elsewhere in North America.

BIBLIOGRAPHY OF THE ICHTHYOLOGY OF THE COLORADO BASIN.

We here give, in chronological order, the titles of the papers which contain information regarding the fishes of the Colorado Basin, with the place of publication and a brief summary of contents. In the tables of species we give the page upon which each species is mentioned, the name under which recorded, and our identification of each. Genera and species described as new are printed in italics.

1848. LIEUT. COL. W. H. EMORY. Notes of a military reconnoissance from Fort Leavenworth, in Missouri, to San Diego, in California, including part of the Arkansas, Del Norte, and Gila Rivers. By Lieut. Col. W. H. Emory, made in 1846-47, with the advanced guard of the "Army of the West." Washington: Wendell and Van Benthuysen, Printers. 1848.

This interesting volume, which was printed as Ex. Doc. No. 41, Thirteenth Congress, first session, contains the first reference which we have been able to find to any fish of the Colorado Basin. The reference is contained in the following extract from pp. 62 and 63, and is accompanied by a full-page plate of the fish named Gila trout, which, of course, is *Ptychocheilus lucius:*

> A good road was subsequently found turning the spur and following the creek, until it debouched into the Gila, which was only a mile distant. Some hundred yards before reaching this river the roar of its waters made us understand that we were to see something different from the Del Norte. Its section, where we struck it (see the map), 4,347 feet above the sea, was 50 feet wide and an average of 2 feet deep. Clear and swift it came bouncing from the great mountains which appeared to the north about 60 miles distant. We crossed the river, its large round pebbles and swift current causing the mules to tread warily. We followed its course, and encamped under a high range of symmetrically formed hills overhanging the river. Our camp resembled very much the center of a yard of huge stacks.
>
> We heard the fish playing in the water, and soon those who were disengaged were after them. At first it was supposed they were the mountain trout, but, being comparatively fresh from the hills of Maine, I soon saw the difference. The shape, general appearance, and the color are the same; at a little distance you will imagine the fish covered with delicate scales, but on a closer examination you will find that they are only the impression of scales. The meat is soft, something between the trout and the catfish, but more like the latter. They are in great abundance.

1853*a*. S. F. BAIRD AND CHARLES GIRARD. Descriptions of some new Fishes from the River Zuñi. <Proc. Ac. Nat. Sci. Phila., VI, 1853, 368, 369.

In this short paper are described and named the first species of fishes ever received from the Colorado Basin. Excepting the brief reference in Lieut. Col. Emory's reconnoissance, which we have quoted above, this is the first mention of Colorado Basin fishes. The specimens described were collected by Dr. S. W. Woodhouse while attached as surgeon and naturalist to the expedition of Capt. Sitgreaves, for the exploration of the Zuñi River and its tributaries. Three species were described from this collection, viz: *Gila robusta*, *Gila elegans*, and *Gila gracilis*. The last of these is now regarded as a synonym of *G. robusta*.

1853*b*. SPENCER F. BAIRD AND CHARLES GIRARD. Fishes collected by the expedition of Capt. L. Sitgreaves, 148-152, with 3 plates, 1853. <Report of an Expedition down the Zuñi and Colorado Rivers, by Captain L. Sitgreaves, Corps Topographical Engineers, 1853.

This paper was based upon the material upon which the same authors reported in the Proceedings of the Philadelphia Academy in 1853. This report, however, is given more in detail and is accompanied by 3 plates containing very good figures of the 3 nominal species—*Gila robusta*, *Gila elegans*, and *Gila gracilis*. This expedition left Zuñi September 24, 1852, and reached Yuma November 30.

1853c. SPENCER F. BAIRD AND CHARLES GIRARD. Descriptions of New Species of Fishes collected by Mr. John H. Clark, on the U. S. and Mexican Boundary Survey, under Lt. Col. Jas. D. Graham. <Proc. Ac. Nat. Sci. Phila., VI, 1853, 387–390.

This is the first of the several papers based upon the collections made by the parties of the Mexican Boundary Survey proper. In it are mentioned 17 species, all of which are described as new. One of these (*Fundulus tenellus*=*Zygonectes notatus*) is described from Prairie Mer Rouge, La., and Russellville, Ky., 11 from Texas, and 5 from the Colorado Basin.

Page.	Species as recorded.	Present identification.	Page.	Species as recorded.	Present identification.
388	Catostomus *latipinnis*	Catostomus latipinnis.	389	Cyprinodon *macularius*	Cyprinodon macularius.
388	Gila *emoryi*	Gila elegans.	390	Heterandria *occidentalis*	Heterandria occidentalis.
389	Gila *grahami*	Gila robusta.			

1854. S. F. BAIRD AND CHARLES GIRARD. Descriptions of new species of Fishes collected in Texas, New Mexico, and Sonora, by Mr. John H. Clark, on the U. S. and Mexican Boundary Survey, and in Texas by Capt. Stewart Van Vliet, U. S. A. Second Part. <Proc. Ac. Nat. Sci. Phila., VII, 1854, 24–29.

This is the second paper by Baird & Girard upon the fishes of the Mexican Boundary Survey. The list contains 19 species, all but 2 of which are described as new. Of these 19 species, 16 were from Texan waters and 3* from the Colorado Basin.

Page.	Species as recorded.	Present identification.	Page.	Species as recorded.	Present identification.
27	Catostomus *clarkii*	Catostomus clarkii.	204	Tiaroga *cobitis*	Tiaroga cobitis.
28	Catostomus *insignis*	Catostomus insignis.	205	Gila robusta	Gila robusta.
28	Gila *gibbosa*	Leuciscus niger.	205	Gila elegans	Gila elegans.

1856. CHARLES GIRARD. Researches upon the Cyprinoid Fishes inhabiting the fresh waters of the United States of America, west of the Mississippi Valley, from specimens in the Museum of the Smithsonian Institution. <Proc. Ac. Nat. Sci. Phila. 1856, 165–209.

This paper mentions 18 species from the Colorado Basin, 9 of which are described as new.

Page.	Species as recorded.	Present identification.	Page.	Species as recorded.	Present identification.
173	Minomus insignis	Catostomus insignis.	205	Gila gracilis	Gila robusta.
173	Minomus clarkii	Catostomus clarkii.	205	Gila grahamii	Gila robusta.
173	Acomus latipinnis	Catostomus latipinnis.	205	Gila emorii	Gila elegans.
186	Argyreus *osculus*	Agosia oscula.	206	Tigoma *intermedia*	Leuciscus intermedius.
186	Argyreus *notabilis*	Agosia oscula.	207	Tigoma gibbosa	Leuciscus niger.
187	Agosia *chrysoga[s]ter*	Agosia chrysogaster.	209	Ptychocheilus *lucius*	Ptychocheilus lucius.
187	Agosia *metallica*	Agosia chrysogaster.	209	Ptychocheilus *vorax*	Gila robusta.
192	Meda *fulgida*	Meda fulgida.			

1858. CHARLES GIRARD. Report upon the Fishes collected by the various Pacific Railroad Explorations and Surveys. Vol. X, part IV, 1–400, with numerous plates.

But little collecting in the Colorado Basin was done by the parties connected with the Pacific railroad surveys. The records mention only three species from this basin. All of these were collected in the Zuñi River in 1852 by Dr. S. W. Woodhouse, under Capt. L. Sitgreaves. Specimens of one of the species (*Gila elegans*) were obtained in the Gila in 1853 by Dr. A. L. Heermann, under Lieut. J. G. Parke; in the Colorado River in 1854 by Arthur Schott, under Maj. Emory; and at Fort Yuma in 1855 by

* In this paper *Catostomus plebeius* (*Pantosteus plebeius*) and *Gila pulchella* (*Leuciscus nigrescens*) are credited to the "Rio Mimbres, tributary of the Rio Gila." But the Rio Mimbres is not a tributary of the Gila, but of Lake Guzman, in Chihuahua, and these two species are not known to occur in the Colorado Basin.

Maj. S. H. Thomas. This species was also collected in 1854 by Mr. Kruzfeld, under Lieut. E. G. Beckwith, but the exact locality is not known. Only three species are mentioned in this report as coming from the Colorado Basin, being the same described by Baird & Girard in 1853 *a*.

1859*a*. CHARLES GIRARD. Ichthyology of the Boundary. <Report of the United States and Mexican Boundary Survey, made under the direction of the Secretary of the Interior, by William H. Emory, Major, First Cavalry, and United States Commissioner. Vol. 3, Washington, 1858. Part on Ichthyology, 1859, 1–85, plates 1–40.

In this final report upon the fishes collected by this survey Girard mentions 17 species as having been obtained in the Colorado Basin. All of these were described in the Proceedings of the Academy of Natural Sciences for the years 1853, 1854, and 1856. Nothing new is added in the Mexican Boundary Report except plates containing illustrations of all the species.

Page.	Species as recorded.	Present identification.	Page.	Species as recorded.	Present identification.
37	Minomus insignis	Catostomus insignis.	61	Gila elegans	Gila elegans.
38	Minomus clarki.	Catostomus clarki.	61	Gila grahami	Gila robusta.
39	Acomus latipinnis	Catostomus latipinnis.	62	Gila emorii	Gila elegans.
47	Argyreus osculus	Agosia oscula.	63	Tigoma intermedia	Leuciscus intermedia.
47	Argyreus notabilis	Agosia oscula.	64	Tigoma gibbosa	Leuciscus niger.
48	Agosia chrysogaster	Agosia chrysogaster.	65	Ptychocheilus lucius	Ptychocheilus lucius.
49	Agosia metallica	Agosia chrysogaster.	68	Cyprinodon macularius	Cyprinodon macularius.
50	Meda fulgida	Meda fulgida.	73	Girardinus occidentalis	Heterandria occidentalis.
60	Tiaroga cobitis	Tiaroga cobitis.			

1859*b*. CHARLES GIRARD, M. D. Ichthyological Notices, XLI–LIX. <Proc. Ac. Nat. Sci. Phila. 1859, 113–122.

On page 119 of this paper Girard describes two female specimens of *Girardinus occidentalis* (= *Heterandria occidentalis*) obtained at Tucson, Ariz., by Arthur Schott, and numerous other specimens obtained at Tucson by Dr. A. L. Heermann.

1860. CHARLES C. ABBOTT. Descriptions of Four New Species of North American Cyprinidæ. <Proc. Ac. Nat. Sci. Phila. 1860, 473, 474.

This paper contains a description of *Gila affinis* (= *Gila robusta*), the specimens erroneously said to be from "Kansas."

1871. E. D. COPE, A. M. Recent Reptiles and Fishes. Report on the Reptiles and Fishes obtained by the Naturalists of the Expedition. <Hayden's Report Geol. Surv. Wyoming for 1870 (1871), 432–442.

In this report Prof. Cope records 13 species from the Colorado Basin, 5 of which he describes as new.

Page	Species as recorded.	Present identification.	Page.	Species as recorded.	Present identification.
433	Urandea punctulata	Cottus bairdi punctulatus.	438	Hybopsis egregius	Leuciscus egregius
433	Salmo (Salar) virginalis	Salmo mykiss pleuriticus.	441	Gila elegans	Gila elegans.
433	Coregonus williamsonii	Coregonus williamsoni.	441	Gila grahamii	Gila robusta.
434	Catostomus latipinne	Catostomus latipinnis.	441	Gila gracilis	Gila robusta.
435	Catostomus *discobolus*	Catostomus latipinnis.	441	Gila *nacrea*	Gila robusta.
435	Minomus *delphinus*	Pantosteus delphinus.	442	Ceratichthys *squamilentus*.	Couesius squamilentus.
436	Minomus *bardus*	Pantosteus delphinus.			

1872. EDWARD D. COPE, A. M. Report on the Recent Reptiles and Fishes of the Survey, collected by Campbell Carrington and C. M. Dawes. <Hayden's Report Geol. Surv. Montana for 1871 (1872), 467–476.

this report Prof. Cope records but one species from the Colorado Basin. This is *Salmo pleuriticus* (= *Salmo mykiss pleuriticus*), which he describes as new.

1874. EDWARD D. COPE, A. M. On the Plagopterinæ and the Ichthyology of Utah.

In this paper 10 species are credited to the Colorado Basin. Seven of these are described as new.

Page.	Species as recorded.	Present identification.	Page.	Species as recorded.	Present identification.
2	*Plagopterus argentissimus.*	Plagopterus argentissimus.	5	Rhinichthys henshavii, *Var. III.*	Rhinichthys cataractæ dulcis.
3	Meda fulgida	Meda fulgida.	6	Hybopsis *timpanogensis*	Leuciscus lineatus.
3	*Lepidomeda vittata*	Lepidomeda vittata.	8	Ceratichthys biguttatus	
4	Lepidomeda *jarrovii*	Lepidomeda jarrovii.	8	Ceratichthys *ventricosus*	Agosia oscula.
5	Rhinichthys henshavii, *Var. II.*	Rhinichthys cataractæ dulcis.	10	Catostomus discobolus	Catostomus latipinnis.

1876. Prof. E. D. COPE AND Dr. H. C. YARROW. Report upon the Collections of Fishes made in portions of Nevada, Utah, California, Colorado, New Mexico, and Arizona, during the years 1871, 1872, 1873, and 1874. <Zoology of the Wheeler Survey west of the 100th meridian, 1875 (1876), 635–703, plates XXVI–XXXII.

This is by far the most important contribution to the literature of the ichthyology of the Colorado Basin that has yet appeared. The authors credit no fewer than 27 species to this basin.

In the body of the report 29 nominal species are recorded from Colorado Basin localities, but 4 of these were apparently erroneously so referred. They are *Gila montana* from "Arizona," *Gila pandora* from "Pagosa, Colo.," *Gila gula* from "Rio de Acama" and "near Fort Wingate, N. Mex.," and *Ptychostomus congestus* from "Ash Creek, Ariz." *Gila montana* (=*Leuciscus hydrophlox*) was probably from some place in the Utah Basin. Both *Gila pandora* and *Gila gula* are now regarded as being identical with *Leuciscus nigrescens*, a Rio Grande species, and Cope & Yarrow's specimens probably came from that basin. *Ptychostomus congestus* (*Moxostoma congestum*) is a Texan species, and the 3 specimens which Cope & Yarrow provisionally referred to this species may have come from some Texan locality.

In the recapitulation of species (p. 699) the authors name 27 species in the Colorado River list, 4 of which are not given in the body of the report, viz: *Ceratichthys squamilentus* (*Couesius squamilentus*), *Pantosteus bardus* (*Pantosteus delphinus*), *Pantosteus delphinus*, and *Coregonus williamsoni*. All of these are properly credited to the Colorado Basin, as had previously been determined by Prof. Cope.

Page.	Species as recorded.	Present identification.	Page.	Species as recorded.	Present identification.
640	Plagopterus argentissimus.	Plagopterus argentissimus.	665	Gila grahamii	Gila robusta.
642	Meda fulgida	Meda fulgida.	666	Gila nacrea	Gila robusta.
642	Lepidomeda vittata	Lepidomeda vittata.	666	Gila *seminuda*	Gila seminuda.
643	Lepidomeda jarrovii	Lepidomeda jarrovii.	667	Gila emorii	Gila elegans.
647	Apocope oscula	Agosia oscula.	667	Siboma atraria	Leuciscus lineatus.
648	Apocope ventricosa	Agosia oscula.	668	Siboma atraria *longiceps*	Leuciscus lineatus.
648	Apocope *couesii*	Agosia couesii.	670	Hyborhynchus *siderius*	Agosia chrysogaster.
651	Ceratichthys biguttatus		674	Pantosteus jarrovii	Pantosteus delphinus.
663	Gila *nigra*	Leuciscus niger.	676	Catostomus insigne	Catostomus insignis.
663	Gila robusta	Gila robusta.	677	Catostomus discobolus	Pantosteus delphinus.
664	Gila elegans	Gila elegans.	693	Salmo pleuriticus	Salmo mykiss pleuriticus
665	Gila gracilis	Gila robusta.	695	Girardinus sonoriensis	Heterandria occidentalis.
			696	Uranidea vheeleri	Cottus bairdi punctulatus.

1876. Prof. THEO. GILL. Report on Ichthyology. <Capt. Simpson's Report of Explorations across the Great Basin of the Territory of Utah, in 1859, 385–431.

In this report *Platygobio communis* (*Platygobio gracilis*) is credited to Green River, Utah, probably erroneously. *Potamocottus punctulatus* is described from a "single specimen obtained by Dr. George Suckley, in the summer of 1859, between Bridger's Pass and Fort Bridger."

1880. WM. N. LOCKINGTON. Description of a New Species of *Catostomus* (*Catostomus cypho*) from the Colorado River. <Proc. Ac. Nat. Sci. Phila. 1880, 237-240.

The single specimen upon which this species was based was obtained from the Colorado River at the mouth of the Gila by John E. Curry, esq., and presented to the Museum of the California Academy of Sciences.

1889. PHILIP H. KIRSCH. Notes on a Collection of Fishes obtained in the Gila River at Fort Thomas, Arizona, by Lieut. W. L. Carpenter, U. S. Army. <Proceedings of the United States National Museum, XI, 1888 (1889), 555-558.

This is a report upon a collection of 7 species of fishes sent by Lieut. Carpenter to the Museum of the University of Indiana. The author describes one new species (*Catostomus gila*) and one new genus (*Xyrauchen*).

Page.	Species as recorded.	Present identification.	Page.	Species as recorded.	Present identification.
555	Catostomus latipinnis	Catostomus latipinnis.	556	*Xyrauchen* cypho	Xyrauchen cypho.
555	Catostomus *gila*	Catostomus gila.	558	Ptychochilus lucius	Ptychocheilus lucius.
556	Catostomus insignis	Catostomus insignis.	558	Gila emorii	Gila elegans.
556	Catostomus clarki	Catostomus clarkii.			

1891. DAVID STARR JORDAN. Report of Explorations in Colorado and Utah during the summer of 1889, with an Account of the Fishes found in each River Basin examined. <Bull. U. S. Fish Commission, IX, 1889 (1891), 1-40, plates 1-5.

During these explorations Dr. Jordan was assisted by Prof. Barton W. Evermann, Mr. Bert Fesler, and Mr. Bradley M. Davis. Next to the Wheeler Survey the collections obtained by this party are the largest and most important that have yet come from the Colorado Basin. The collections contain 10 species and represent 18 Colorado Basin localities. The following is a list of the species contained in these collections:

Page.	Identification.	Page.	Identification.
26	Catostomus latipinnis	27	Gila elegans.
26	Xyrauchen cypho	28	Ptychocheilus lucius.
26	Xyrauchen *uncompahgre*	28	Agosia *yarrowi*.
27	Pantosteus delphinus	28	Salmo mykiss pleuriticus.
27	Gila robusta	29	Cottus bairdi punctulatus.

In August, 1893, while on their way to Idaho, the present writers stopped one day at Green River, Wyo., where the Green River was examined and a small collection of fishes made. The river was seined from a point about 1½ miles above the town down to below the railroad bridge. At that time (August 1) the stream averaged about 125 feet wide and at least 3 feet deep; the current flowed about 1½ feet per second, and the temperature was about 70° at noon. The water was very green where deep; though clear, it contains a good deal of alkali. The bottom of the channel is of gravel, shale, mud, and sand in different places. The shores are of adobe or sand and gravel where low, but of sandstone or shale where high. The left bank of the river above the town is of very high and picturesque cliffs and buttes of shale and sandstones of varied colors; and the deep side of the stream is at the foot of these cliffs. Seven species of fishes were obtained by us. These represent the result of almost constant seining for the greater part of a day, and thus indicate the paucity of species in this stream.

Our notes on this collection will be found under the appropriate species in the following list.

LIST OF SPECIES OF FISHES KNOWN FROM THE COLORADO BASIN.

In the following list we give under each species, in chronological order, the different places in the Colorado Basin from which it has been recorded. When a tabular form is used, the name under which the species was recorded is given in the first column, the locality from which recorded in the second, the name of the collector in the third, and the authority in the last. When two or more papers by the same author appeared in the same year, they are designated as *a*, *b*, *c*, etc. The names of species described as new from the Colorado Basin are printed in italics in connection with the type locality.

CATOSTOMIDÆ. (The Sucker Family.)

1. Pantosteus arizonæ Gilbert. Salt River, Tempe, Ariz. (type, Gilbert, 1895).

2. Pantosteus delphinus (Cope).

Nominal species.	Locality.	Collector.	Authority.
Minomus *delphinus*	Probably a tributary of Green River.	Hayden collection	Cope, 1871.
Minomus *bardus*	do	do	Do.
Pantosteus jarrovii	Zuñi River, New Mexico	H. W. Henshaw	Cope & Yarrow, 1876.
Do	Tierra Armarilla, New Mexico	Yarrow & Shedd	Do.
Pantosteus delphinus	Eagle River, Gypsum, Colo	Evermann & Davis	Jordan, 1889.
Do	Gunnison River, Delta, Colo	Jordan, Evermann, Fesler & Davis.	Do.
Do	Uncompahgre River, Delta, Colo	do	Do.
Do	Rio de las Animas Perdidas, Durango, Colo.	do	Do.
Do	Rio Florida, Durango, Colo	do	Do.
Do	Green River, Green River	Evermann & Rutter	Evermann & Rutter, 1895.

This species we found abundant in Green River. The specimens secured do not differ materially from those collected by Jordan & Evermann in the Gunnison and Uncompahgre rivers in 1889.

3. Pantosteus clarkii (Baird & Girard).

Nominal species	Locality.	Collector.	Authority.
Minomus *clarkii*	Rio Santa Cruz	John N. Clark	Baird & Girard, 1854.
Do	do	do	Girard, 1859.
Catostomus clarki	Gila River, Ft. Thomas, Ariz	Lieut. W. L. Carpenter	Kirsch, 1889.

4. Catostomus latipinnis (Baird & Girard).

Nominal species.	Locality.	Collector.	Authority.
Catostomus *latipinnis*	Rio San Pedro, tributary of Gila	John H. Clark	Baird & Girard, 1853*c*.
Acomus latipinnis	do	do	Girard, 1856 and 1859.
Catostomus latipinne	Green River	Hayden collections	Cope, 1871.
Catostomus latipinnis	do	Jordan, Evermann, Fesler & Davis.	Jordan, 1889.
Do	Gila River, Ft. Thomas, Ariz	Lieut. Carpenter	Kirsch, 1889.
Do	Gunnison River, Delta, Colo	Jordan, Evermann, Fesler & Davis.	Jordan, 1889.
Do	Uncompahgre River, Delta, Colo	do	Do.
Do	Green River, Green River, Wyo	Evermann & Rutter	Evermann & Rutter, 1895.

This was even more abundant at Green River than *P. delphinus* and was found in the same places as that species. They both seem to prefer rather deep, quiet pools with mud bottoms. These specimens agree with others from Delta, Colo., with which they have been compared. The species is close to *Catostomus griseus*, the latter having a longer, slenderer snout and smaller fins.

5. Catostomus gila Kirsch. Types taken in the Gila River at Fort Thomas, Ariz., by Lieut. W. L. Carpenter, and described by Kirsch in 1889.

6. **Catostomus insignis** Baird & Girard.

Nominal species.	Locality.	Collector.	Authority.
Catostomus *insignis*	Rio San Pedro	John H. Clark	Baird & Girard, 1854.
Do	do	do	Girard, 1856 and 1859.
Catostomus insigne	Ash Creek, Arizona	Dr. J. T. Rothrock	Cope & Yarrow, 1876.
Do	"New Mexico"	Dr. Oscar Loew	Do.
Catostomus insignis	Gila River, Ft. Thomas, Ariz	Lieut. Carpenter	Kirsch, 1889.

7. **Xyrauchen cypho** (Lockington).

Nominal species.	Locality.	Collector.	Authority.
Catostomus *cypho*	Colorado River at mouth of the Gila River.		W. N. Lockington, 1880.
Xyrauchen cypho	Gila River, Ft. Thomas, Ariz	Lieut. Carpenter	Kirsch, 1889.
Do	Green River, Blake City, Utah	Jordan	Jordan, 1889.
Do	Gunnison River, Delta, Colo	do	Do.
Do	Uncompahgre R., Delta, Colo	do	Do.

8. **Xyrauchen uncompahgre** Jordan & Evermann. Types taken in the Uncompahgre River near the railway station at Delta, Colo., by Jordan, Evermann, Fesler & Davis, and described by Jordan & Evermann in 1889.

CYPRINIDÆ. (The Minnow Family.)

The bulk of the species of the Colorado Basin belong to this family.*

9. **Ptychocheilus lucius** Girard.

Nominal species.	Locality.	Collector.	Authority.
Gila trout	Gila River	Lieut. Col. W. H. Emory	Emory, 1848.
Ptychocheilus *lucius*	Rio Colorado	A. Schott	Girard, 1856 and 1859.
Do	Gila River, Ft. Thomas, Ariz	Lieut. Carpenter	Kirsch, 1889.
Do	Gunnison River, Delta, Colo	Jordan, Evermann, Fesler & Davis.	Jordan, 1889.
Do	Uncomphagre R., Delta, Colo	do	Do.
Do	Green R., Blake City, Utah	do	Do.
Do	Green River, Green River, Wyo	Evermann & Rutter	Evermann & Rutter, 1895.

We did not secure any specimens of this large cyprinoid at Green River, but were told that it is a common fish in that part of the Green River. It is locally known as "whitefish," "white salmon," or "salmon," and individuals weighing 8 to 10 pounds are often taken with the hook.

10. **Gila elegans** Baird & Girard.

Nominal species.	Locality.	Collector.	Authority.
Gila *elegans*	Zuñi River	Dr. Woodhouse	Baird & Girard, 1853*a* and 1853*b*.
Gila *emoryi*	Near mouth of Gila River	John L. LeConte	Baird & Girard, 1853*c*.
Do	Gila River	do	Girard, 1856.
Gila elegans	Colorado River	A. Schott	Girard, 1856, 1858.
Gila emoryi	Gila River	John L. LeConte	Girard, 1858.
Gila elegans	Zuñi River	Dr. Woodhouse	Do.
Gila emoryi	Near mouth of Gila River	John L. LeConte	Girard, 1859.
Gila elegans	Colorado River, Cal	A. Schott	Do.
Do	Forks of Green River	Hayden collection	Cope, 1871.
Do	Ft. Bridger, Wyo	do	Do.
Do	San Juan River, New Mexico	Lieut. Birnie	Cope & Yarrow, 1876.
Do	Southwestern Arizona	F. Bischoff	Do.
Gila emorii	Gila River	Lieut. Carpenter	Kirsch, 1889.
Gila elegans	Gunnison River, Delta, Colo	Jordan, Evermann, Fesler & Davis.	Jordan, 1889.
Do	Green River, Blake City, Utah	Dr. Jordan	Do.

* **Cyprinus carpio** Linnæus. *The German Carp.* This species was introduced from Europe into the United States in 1875 by the Government, and even earlier by private individuals. From the ponds it has escaped to the rivers and is now found in many of the larger rivers, including the Colorado.

11. Gila robusta Baird & Girard.

Nominal species.	Locality.	Collector.	Authority.
Gila *robusta*	River Zuñi	Dr. Woodhouse	Baird & Girard, 1853*a*, 1853*b*.
Gila *gracilis*	do	do	Do.
Gila *grahami*	Rio San Pedro, tributary of Rio Gila	John H. Clark	Baird & Girard, 1853*c*.
Ptychocheilus *vorax*	Unknown	Lieut. Beckwith	Girard, 1856.
Gila robusta	River Zuñi	Dr. Woodhouse	Do.
Gila grahamii	Rio San Pedro, tributary of Rio Gila	John H. Clark	Do.
Gila gracilis	River Zuñi	Dr. Woodhouse	Girard, 1856, 1858.
Gila robusta	do	do	Girard, 1858, 1859.
Gila grahami	Rio San Pedro, tributary of Rio Gila	John H. Clark	Do.
Gila *affinis*	"Kansas"; evidently an error	W. A. Hammond	Abbott, 1860.
Leuciscus *zunnensis*	Zuñi River	Dr. Woodhouse	Günther, 1868.
Gila grahami	Ft. Bridger	Hayden collection	Cope, 1871.
Gila gracilis	do	do	Do.
Do	Henry's Fork of Green River	do	Do.
Gila grahamii	do	do	Do
Gila gracilis	Forks of Green River	do	Do.
Gila nacrea	do	Campbell Carrington	Do
Gila robusta	Gila River	H. W. Henshaw	Cope & Yarrow, 1876.
Gila grahamii	do	Jas. M. Rutter	Do.
Gila robusta	Arizona	H. W. Henshaw	Do.
Gila gracilis	White River, Arizona	do	Do.
Gila grahamii	do	Loew, Henshaw & Rutter	Do
Do	Camp Apache	Dr. Loew	Do.
Do	Colorado Chiquito	Dr. Newberry	Do.
Do	Ash Creek, Arizona	Dr. Rothrock	Do.
Gila nacrea	Green River, Wyoming		Do.
Gila robusta	Uncompahgre R., Delta, Colo	Jordan, Evermann, Fesler & Davis.	Jordan, 1889.
Do	Gunnison River, Delta, Colo	do	Do.
Do	Green River, Green River, Wyo	Evermann & Rutter	Evermann & Rutter, 1895.
Do	Babacomari Creek, Ariz	Dr. A. K. Fisher	Do.

This species seems to be distributed throughout the Colorado River Basin and is extremely variable. Compared with specimens from Salt River at Tempe, Ariz., ours from Green River differ in the obviously smaller eye and the possibly wider union of the gill-membranes with the isthmus. If, on further investigation, a northern form is found separable from the southern, it will bear the name *nacrea* Cope. The following is a detailed description of the six examples taken by us in Green River at Green River, Wyo., near the type locality of *Gila nacrea:*

Head, $3\frac{3}{4}$ to 4; depth, $4\frac{2}{3}$ to $4\frac{9}{10}$; eye, $3\frac{3}{4}$ to 4; snout, $3\frac{1}{4}$ to 4; interorbital width, $2\frac{3}{4}$; D. 9 or 10; A. 9 or 10; scales, 23 to 25-85 to 103-13 or 14; teeth, 2, 5-4, 2, hooked, no grinding surface. Body moderately slender, head broad, the upper profile longitudinally and transversely convex; snout decurved; mouth oblique, jaws subequal, maxillary barely reaching beyond front of orbit, about as long as from tip of snout to pupil; interorbital space very convex, $1\frac{3}{5}$ times diameter of eye; back not strongly arched; caudal peduncle rather slender, compressed, the least depth 4 in head. Origin of dorsal behind insertion of ventrals, midway between nostrils and base of middle caudal rays; anterior dorsal rays somewhat produced, their length $1\frac{1}{7}$ in head; anal smaller, length of longest ray $1\frac{1}{3}$ in head, equal to length of pectoral; pectorals not quite reaching ventrals, the latter barely reaching vent, $1\frac{3}{5}$ in head; caudal widely forked, the lobes longer than head. Scales very small, crowded on back; lateral line strongly decurved.

Two of these specimens, $3\frac{1}{2}$ and 4 inches long, respectively, differ from the others in having a shorter, blunter head, and a slightly deeper caudal peduncle.

12. Gila seminuda Cope & Yarrow. Types taken in the Rio Virgen, Washington, Utah, and described by Cope & Yarrow in 1876.

13. Leuciscus lineatus (Girard).

Nominal species.	Locality.	Collector.	Authority.
Hybopsis *timpanogensis*	Gunnison River	Mr. Klett	Cope, 1874.
Do	do	do	Cope & Yarrow, 1876.
Siboma atraria	do	Mr. Henshaw	Do.
Do	Zuñi River	do	Do.
Do	Colorado Chiquito River, New Mexico.	do	Do.
Siboma atraria *longiceps*	Colorado Chiquito River	Dr. Newberry	Do.
Do	Snake Creek, Nevada	Dr. Yarrow	Do.
Do	Rio Virgen	do	Do.

14. Leuciscus intermedius (Girard). Types taken in the Rio San Pedro, tributary of Rio Gila, by John H. Clark, and described as *Tigoma intermedia* by Girard in 1856 and 1859.

15. Leuciscus niger (Cope).

Nominal species.	Locality.	Collector.	Authority.
Gila *gibbosa*	Rio Santa Cruz, tributary of Rio Gila.	John H. Clark	Baird & Girard, 1834.
Tigoma gibbosa	Tucson, Sonora, Ariz	Heermann & Clark	Girard, 1856, 1859.
Do	Rio Santa Cruz, tributary of Rio Gila.	John H. Clark	Girard, 1859.
Gila *nigra*	Ash Creek, Arizona	Dr. Rothrock	Cope & Yarrow, 1876.
Do	San Carlos, Arizona	H. W. Henshaw	Do.

16. Leuciscus egregius Cope. Types taken in the Green River by the Hayden expedition and described as *Hybopsis egregius* by Cope in 1871.

17. Tiaroga cobitis Girard. Types taken in the Rio San Pedro, tributary of Rio Gila, by John H. Clark, and described by Girard in 1856 and 1859.

18. Rhinichthys cataractæ dulcis (Girard).

Nominal species.	Locality.	Collector.	Authority.
Rhinichthys henshavii, *var. II*	Colorado Chiquito	H. W. Henshaw	Cope, 1874.
Rhinichthys henshavii, *var. III*	Camp Apache, Arizona	do	Do.

19. Agosia oscula (Girard).

Nominal species.	Locality.	Collector.	Authority.
Argyreus *osculus*	Babacomari, tributary of Rio San Pedro, tributary of Rio Gila.	John H. Clark	Girard, 1856, 1859.
Argyreus *notabilis*	Rio Santa Cruz	do	Do.
Ceratichthys *ventricosus*	From Arizona		Cope, 1874.
Apocope oscula	Camp Apache, Arizona	H. W. Henshaw	Cope & Yarrow, 1876.
Do	Zuñi River	G. M. Keasby	Do.
Do	Pagosa, Colorado	Yarrow & Allen	Do.
Apocope ventricosus	From Arizona		Do.
Do	From New Mexico		Do.

20. Agosia yarrowi Jordan & Evermann.

Nominal species.	Locality.	Collector.	Authority.
Agosia *yarrowi*	Tomichi Creek, Colo	Jordan, Evermann, Fesler & Davis.	Jordan, 1889.
Do	Gunnison River, Gunnison	do	Do.
Do	Gunnison River, Delta, Colo	do	Do.
Do	Uncompahgre River, Delta	do	Do.
Do	Green River, Blake City, Utah	Dr. Jordan	Do.
Do	Eagle River, Gypsum, Colo	Evermann & Davis	Do.
Do	Rio de las Animas Perdidas, Durango, Colo.	Jordan, Evermann, Fesler & Davis.	Do.
Do	Rio Florida, Durango, Colo	do	Do.
Do	Leiter Creek, Durango, Colo	do	Do.
Do	Green River, Green River, Wyo	Evermann & Rutter	Evermann & Rutter, 1895.

Our collection from Green River, Wyoming, contains 57 specimens, which we provisionally refer to this species. They show some differences, however, and may prove to be an undescribed species. The following is a description of these specimens: Head, 4; depth, $4\frac{1}{3}$; eye, 5; snout, $2\frac{2}{3}$; interorbital width, $3\frac{1}{3}$. D. I, 8; A. I, 7; scales, 13–73–10, about 30 before the dorsal. Body rather slender, compressed; head long, snout long; mouth inferior, horizontal; barbel present; opercle rather short and evenly rounded. Caudal peduncle long, compressed, and rather deep. Scales larger than in *A. yarrowi*, much reduced in size on back on anterior part of body; lateral line complete, nearly straight.

Fins moderate, the height of the dorsal 1⅓ in head, the free edge somewhat concave; origin of dorsal fin behind ventrals, midway between base of middle caudal rays and nostril; anal fin falcate, its anterior rays equal to longest dorsal rays; pectorals rather short, 1⅓ in head, not reaching ventrals; ventrals short, barely reaching front of anal fin; caudal fin widely forked. Color in alcohol, olivaceous above, with darker marbling and small dark spots scattered irregularly over back and sides, few of which are, however, found below lateral line; under parts pale straw-color or silvery; fins all plain. The numerous specimens show but little variation from the above description, except in the squamation; the number of scales in the lateral line varies from 70 to 76. Occasionally there are 9 dorsal rays; eye, 4½ to 5; depth, 4⅕ to 4½; head, 4 to 4¼. From specimens of *Agosia yarrowi*, from Gunnison, Colo., these differ in having larger scales (16–74 to 80–13 in *yarrowi*), deeper and more compressed caudal peduncle, and narrower head.

This species was found to be quite abundant at Green River. It seemed to go in schools and to be found in the current, where they were feeding upon the gravelly bottom. At some hauls of the seine none at all would be taken, while at others considerable numbers would be secured.

21. Agosia couesii (Yarrow). Types from near Camp Apache, Arizona, described as *Apocope couesi* by Yarrow in 1876, and recorded by Cope & Yarrow, 1876.

22. Agosia chrysogaster Girard.

Nominal species.	Locality.	Collector.	Authority.
Agosia *chrysogaster*	Rio Santa Cruz	John H. Clark	Girard, 1856. 1859.
Agosia *metallica*	Rio San Pedro, tributary of Rio Gila.	do	Do.
Hyborhynchus *siderius*	Camp Lowell, Arizona	Jas. M. Rutter	Cope & Yarrow, 1876.

23. Couesius squamilentus Cope. Types from Henry Fork of Green River, Hayden collection, described as *Ceratichthys squamilentus* by Cope, 1871.

24. Lepidomeda vittata Cope. Types collected in the Colorado Chiquito by Dr. Newberry, described by Cope in 1874, and again recorded by Cope & Yarrow, 1876.

25. Lepidomeda jarrovii Cope. Types collected in the Colorado Chiquito by Yarrow & Henshaw, and described by Cope in 1874, and recorded by Cope & Yarrow, 1876.

26. Meda fulgida Girard.

Nominal species.	Locality.	Collector.	Authority.
Meda *fulgida*	Rio San Pedro, tributary of Rio Gila.	John H. Clark	Girard, 1856, 1859.
Do	do	Yarrow & Henshaw	Cope, 1874.
Do	do	do	Cope & Yarrow, 1876.

27. Plagopterus argentissimus Cope. Types from San Luis Valley in western Colorado, described by Cope, 1874, and again reported by Cope & Yarrow, 1876.

28. Salmo mykiss pleuriticus (Cope).

Nominal species.	Locality.	Collector.	Authority.
Salmo (Salar) virginalis	Near Ft. Bridger, Wyo	Hayden collection	Cope, 1871.
Do	Henry Fork of Green River	do	Do.
Salmo *pleuriticus*	Headwaters of Green River	Carrington & Logan	Cope, 1872.
Do	White River, Ariz	H. W. Henshaw	Cope & Yarrow, 1876.
	White Mountains, Ariz	do	Do.
	Pagosa, Colo	C. B. Aiken	Do.
Salmo mykiss pleuriticus	Trapper Lake, Colorado	Jordan, Evermann, Fesler & Davis.	Jordan, 1889.
Do	Eagle River, Gypsum, Colorado	Evermann & Davis	Do.
Do	Cañon Creek, Glenwood Springs, Colo.	Jordan, Evermann, Fesler & Davis.	Do.
Do	Sweetwater Lake, Eagle Co., Colo.	do	Do.
Do	Gunnison River, Gunnison, Colo	do	Do.
Do	Rio Florida, Durango, Colo	do	Do.

No trout were seen by us at Green River, but we were informed that they are occasionally taken there and that they are common further up the river in the small tributaries.

29. **Coregonus williamsoni** Girard. *Rocky Mountain Whitefish.* The only reference to this species which we have seen, applying to this basin, is that of Cope, 1871, who had specimens in the Hayden collections, probably from Green River, near Fort Bridger. Numerous young individuals were taken by us at Green River, Wyoming, where it is a common fish, attaining considerable size and being of value as a food-fish.

30. **Cyprinodon macularius** Baird & Girard. The types of this species were collected by John H. Clark in the Rio Gila and described by Baird & Girard in 1853 (*c*). In the Mexican Boundary Survey Girard credits the same specimens to the Rio San Pedro of the Gila. Only the types are known.

31. **Heterandria occidentalis** Baird & Girard.

Nominal species.	Locality.	Collector.	Authority.
Heterandria *occidentalis*	Rio Santa Cruz	John H. Clark	Baird & Girard, 1853 *c*.
Girardinus occidentalis	do	do	Girard, 1859 *a*.
Do	Tucson	Dr. Heermann; Arthur Schott	Girard, 1859 *b*.
Girardinus sonoriensis	Camp Lowell, Ariz	H. W. Henshaw	Cope & Yarrow, 1876.

32. **Cottus bairdi punctulatus** (Gill). *Blob; "Bullhead."*

Nominal species.	Locality.	Collector.	Authority.
Uranidea punctulata	Headwaters of Green River	Hayden collections	Cope, 1871.
Potamocottus punctulatus	Between Bridger Pass and Fort Bridger.		Gill, 1876.
Uranidea vheeleri	Rio San Juan, Pagosa, Colo	Yarrow & Aiken	Cope, 1876.
Cottus bairdi punctulatus	Eagle River, Gypsum, Colo	Evermann & Davis	Jordan, 1889.
Do	Roaring Fork, Glenwood Springs, Colo.	Jordan, Evermann, Fesler & Davis.	Do.
Do	Gunnison River, Gunnison, Colo	do	Do.
Do	Gunnison River, Delta, Colo	do	Do.
Do	Rio Florida	do	Do.
Do	Leitner Creek, Durango, Colo	do	Do.
Do	Rio de las Animas Perdidas, Durango, Colo.	do	Do.
Do	Green River, Green River, Wyo	Evermann & Rutter	Evermann & Rutter, 1895.

The blob was quite abundant at Green River, but most of the individuals secured were young. They were found in greatest numbers in some small isolated ponds or pools on the river bank.

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